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THE EFFECTS OF UNIVERSAL DESIGN FOR LEARNING ON THE ACADEMIC ENGAGEMENT OF MIDDLE SCHOOL STUDENTS

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THE EFFECTS OF UNIVERSAL DESIGN FOR LEARNING
ON THE ACADEMIC ENGAGEMENT OF MIDDLE SCHOOL STUDENTS

by

Kimberly M. Johnson-Harris

B.S., Southern Illinois University Edwardsville, 1996

M.S., Southern Illinois University Edwardsville, 1999

A Dissertation

Submitted in Partial Fulfillment of the Requirements for the
Doctor of Philosophy in Educational Psychology & Special Education

Department of Educational Psychology & Special Education
in the Graduate School

Southern Illinois University Carbondale

May 2014

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DISSERTATION APPROVAL

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Kimberly M. Johnson-Harris

A Dissertation Submitted in Partial

Fulfillment of the Requirements

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Doctor of Philosophy

in the field of Educational Psychology and Special Education

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March 26, 2014

AN ABSTRACT OF THE DISSERTATION OF

KIMBERLY M. JOHNSON-HARRIS, for the Doctor of Philosophy degree in EDUCATIONAL PSYCHOLOGY & SPECIAL EDUCATION, presented on March 26, 2014 at Southern Illinois University Carbondale.

TITLE: THE EFFECTS OF UNIVERSAL DESIGN FOR LEARNING ON THE ACADEMIC ENGAGEMENT OF MIDDLE SCHOOL STUDENTS

MAJOR PROFESSOR: Dr. Nancy A. Mundschenk

A multiple baseline across participants design was used to examine the impact of Universal Design for Learning (UDL), implemented as a total framework, on the academic engagement of middle school students with emotional or behavioral disorders (EBD), and students who are at-risk for academic failure due to behavior problems, who are included in general education classes. Five teachers from two middle schools participated in professional development on UDL and UDL lesson plan design and then implemented UDL lessons in their classes. Data were collected on the fidelity of UDL implementation, student academic engagement during lesson plan implementation, and teacher acceptability of UDL. Results from implementation fidelity data indicated that after professional development on UDL, the teachers designed and implemented UDL lessons with limited fidelity. Results from student engagement data indicated that brief and limited exposure to UDL is insufficient to produce measureable improvements in student engagement, although increased interest and involvement was noted during specific types of UDL-related learning activities. Results from the teacher acceptability survey indicated that the teachers found UDL to be an acceptable treatment for improving engagement, but they were somewhat uncomfortable with a student-centered classroom and thought UDL was time consuming to implement.

DEDICATION

With all my heart...

To Ron Harris, my husband, my best friend, my solid rock, my center.

The one who sees me even when I am invisible.

To Noah Harris, my son, my heart, my comic relief.

I cannot wait to see the amazing things you will do with your life.

To Johanna and Bill Johnson, my parents.

Somehow you instilled in me the belief that I can do anything. Thank you.

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It always seems impossible until it's done.

—Nelson Mandela

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CHAPTER 1

INTRODUCTION

Considered by many to be a low estimate of the actual number of children and youth with emotional and behavioral disorders (Heward, 2009; Kauffman & Landrum, 2009a; T. Lewis, Jones, Horner, & Sugai, 2010), only 0.9% of the total school age population currently receives special education services under the eligibility category of EBD (U.S. Department of Education, 2010). These students represent a challenge in the educational system because of the educational and behavioral difficulties they bring to the classroom. Their disruptive behaviors often demand an inordinate amount of teacher attention and compromise the learning environment for other students (Lane, 2007). Equally challenging is the fact that many students with EBD also have learning deficits in reading, math, and written language (Cullinan, Evans, Epstein, & Ryser, 2003; Cullinan & Sabornie, 2004; J. R. Nelson, Babyak, Gonzalez, & Benner, 2003).

Because of their multiple needs and their difficulty functioning in a variety of settings, children and youth with EBD are often involved with an array of service providers (Malmgren & Meisel, 2002). Dual involvement in mental health and juvenile justice is not uncommon among this population (Graves, Frabutt, & Shelton, 2007; Huang, Ryan, & Herz, 2012; Rosenblat, Rosenblat, & Biggs, 2000), and children and youth who are involved in mental health or juvenile justice systems frequently qualify for special education services under the eligibility category of emotional disturbance (Foley, 2001; Quinn, Rutherford, Leone, Osher, & Poirier, 2005).

Like professionals in other fields, those who work with children and youth with EBD operate from a foundational conceptual model that drives their assumptions about etiology, identification, and effective treatments or interventions (Kauffman & Landrum, 2009a). Each group of service providers has a different perspective and agenda when it comes to identifying,

categorizing, and providing services to children and youth with EBD. Conceptual models overlap, and most professionals do not subscribe to a single paradigm (Kauffman & Landrum, 2009a). Understanding the framework from which a group or individual operates can explain why they strive to work with children and youth in a specific way, or why they are reluctant to work with them.

In order for children and youth with EBD to qualify for mental health services, for example, they must have a diagnosable disorder (Cullinan, 2004) identified in the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2000). Medical professionals in this field (e.g., psychiatrists, physicians) operate largely from a biological or medical conceptual model. They look for physiological causes of behavioral or emotional problems and treat the problems with physiological interventions such as medication (Kauffman & Landrum, 2009a). Psychologists and social workers in the mental health field often subscribe to a psychoeducational, or ecological model, which takes into account internal motivation and social context for behavior (Kauffman & Landrum, 2009a). They attempt to help the children overcome their emotional or behavioral problems by helping them learn why they behave the way they do, and then teaching them strategies for self-control (Frey & George-Nichols, 2003; McManama O'Brien et al., 2011).

Children and youth with EBD are often also involved with the juvenile justice system (Graves et al., 2007). The juvenile justice system has operated from both a punitive conceptual model, and a rehabilitative conceptual model (Grisso, 2007; C. M. Nelson, Jolivet, Leone, & Mathur, 2010; C. Peters, 2011). It began as a diversion program to guide youthful offenders away from the criminal court system (Tanenhaus, 2002), but from the beginning, the juvenile justice system has alternated between the punitive and rehabilitative models. The punitive model

stresses social control and prescribes punishment that is equal to the crime, while the rehabilitative model stresses social welfare, which views the offender as a victim of circumstances, and seeks ameliorating resources (Morris & McIsaac, 1978). Even when the attitudes of professionals in the juvenile justice system sway toward a rehabilitative model (Mears, Shollenberger, Willison, Owens, & Butts, 2010; Ward & Kupchik, 2010), the overall system of juvenile justice is clearly focused on community security and safety.

Special educators and school social workers who work with students with EBD typically adopt a behavioral model in which antecedents and consequences are manipulated in order to teach appropriate behavior (Landrum, Tankersley, & Kauffman, 2003), or they follow a slightly more eclectic social-cognitive model where behaviors are understood by considering the interaction of the person, environment, and behavior (Kauffman & Landrum, 2009a). Special educators attempt to design the learning environment and the instructional activities so that desirable behaviors are maximized and undesirable behaviors are minimized for individual students. School social workers provide additional behavioral and mental health support for individual students by collaborating with educators and putting families in touch with outside service agencies when necessary (Kline & Silver, 2004).

General educators are influenced by a legal conceptual model (Kauffman, 2007) that focuses attention on groups of students rather than individual students. This becomes evident when the laws that govern special education (i.e., Individuals with Disabilities Education Act; IDEA) and general education (i.e., No Child Left Behind; NCLB) are examined: IDEA focuses on individual students while NCLB focuses on groups of students (Johns, 2003). The high stakes testing component of NCLB, which threatens severe sanctions for schools not meeting state standards (Yell, Katsiyannis, & Shiner, 2006), reinforces general education teachers'

pedagogical bent to teach to the majority by focusing on content knowledge (e.g., mathematics, science, literature) and general pedagogical knowledge (Loewenberg Ball, Hoover Thames, & Phelps, 2008; Shulman, 1987) which enables them to efficiently teach their subject matter to the greatest number of students. To this end, general education teachers use large group (i.e., whole class) instruction more frequently than small group instruction (Gelzheiser, Meyers, Slesinski, Douglas, & Lewis, 2012; Moody, Vaughn, & Schuum, 2012), and they use lecture, drill and practice, and teacher-directed instruction more frequently than more personal instructional techniques (McKinney & Frazier, 2008). Students with EBD are often excluded from general education classrooms and placed in more restrictive settings when their disruptive behaviors threaten the structure of the classroom and undermine the teacher's ability to instruct the whole class without interruption (Wilkinson, 2005).

When making an argument against the regular education initiative in the late 1980s, Kauffman, Gerber, and Semmel (1988) pointed out that teachers are often faced with the quandary of choosing between working toward improving the performance of the larger homogenous group, or attempting to narrow the gap between that group and students with or at risk for disabilities. Indeed, twenty-five years ago it was inconceivable that teachers could effectively teach all students, but prophetically, Kauffman et al. (1988) conceded that the needs of all students could, in fact, be met with the availability of “new resources” and “more powerful instructional technologies” (p. 10) – the kinds of things now available in the 21st century.

Definition of EBD

Given the diversity of conceptual models, it is not surprising that there is no universally accepted definition of EBD, and that a number of terms are used to describe this population including *serious emotional disturbance*, *emotional disturbance* and *emotional and behavioral*

disorders. The Individuals with Disabilities Education Improvement Act (2004) uses the term emotional disturbance (ED), and defines it as:

(i) A condition exhibiting one or more of the following characteristics over a long period of time and to a marked degree that adversely affects a child's educational performance:

- A) An inability to learn that cannot be explained by intellectual, sensory, or health factors.
- B) An inability to build or maintain satisfactory interpersonal relationships with peers and teachers.
- C) Inappropriate types of behavior or feelings under normal circumstances.
- D) A general pervasive mood of unhappiness or depression.
- E) A tendency to develop physical symptoms or fears associated with personal or school problems.

(ii) Emotional disturbance includes schizophrenia. The term does not apply to children who are socially maladjusted, unless it is determined that they have an emotional disturbance under paragraph (c)(4)(i) of this section. (P.L. 108-446, 20 C.F.R. § 300.8 [c][4]).

Kauffman and Landrum (2009) and Heward (2009) point out that the federal definition of EBD is vague and subjective, and that the addenda related to educational performance and social maladjustment create additional confusion for practitioners and researchers. This confusion and the apparent contradiction in the federal definition ultimately lead to some students with EBD being excluded from services (Kauffman, Mock, & Simpson, 2007; T. Lewis et al., 2010; Mathur, 2007; Merrell & Walker, 2004; C. M. Nelson & Kauffman, 2009). A student who

demonstrates behavior or emotional problems for example, but who adequately progresses in the general curriculum, may well be denied services until he or she falls behind academically (Donovan & Cross, 2002). With regard to the social maladjustment exclusionary clause, Kauffman and Landrum (2009) point out that a logical definition of social maladjustment would surely include at least one of the five characteristics delineated in the federal definition, thereby making the exclusionary clause irrelevant.

Because of the confusion surrounding the current federal definition, the National Mental Health and Special Education Coalition, which was made up of representatives from several agency stakeholders (e.g., American Academy of Child and Adolescent Psychiatry, American Psychiatric Association, American Psychological Association, Council for Children with Behavioral Disorders, Council for Exceptional Children, National Mental Health Association), developed an alternative definition (Forness & Knitzer, 1992). The alternative definition uses the term *emotional or behavioral disorder* rather than *emotional disturbance*, and reads as follows:

- (i) The term *Emotional or Behavioral Disorder* (EBD) means a disability characterized by behavioral or emotional responses in school so different from appropriate age, cultural, or ethnic norms that they adversely affect educational performance. Educational performance includes academic, social, vocational, and personal skills. Such a disability
 - (a) is more than a temporary, expected response to stressful events in the environment;
 - (b) is consistently exhibited in two different settings, at least one of which is school-related; and

- (c) is unresponsive to direct intervention in general education, or the condition is such that general interventions would be insufficient.
- (ii) Emotional and behavioral disorders can co-exists with other disabilities.
- (iii) This category may include children or youth with schizophrenic disorders, affective disorders, anxiety disorders, or other sustained disturbances of conduct or adjustment when they adversely affect educational performance in accordance with section 1 (Forness & Knitzer, 1992, p. 13).

Unfortunately, this definition was not considered in subsequent reauthorizations of the Individuals with Disabilities Education Act (IDEA; 2004) because of opposition by the National School Boards Association (NSBA). The NSBA was concerned that more children would be identified for special education services, and funding for other needs would be depleted as a result (Forness & Kavale, 2000; Merrell & Walker, 2004).

Despite the unchanged definition, the term *emotional or behavioral disorder* has been adopted by the special education and mental health communities (Forness & Kavale, 2000), and is generally accepted and used by researchers and professional organizations in the field of special education (CCBD, 2000; Forness & Kavale, 2000; Kauffman & Landrum, 2009a). The term emotional or behavioral disorder (EBD) will be used throughout this dissertation.

Characteristics of Students with EBD

Even within the field of special education, professionals find it difficult to agree on a definition of EBD because of ambiguity over what constitutes disordered behavior (Heward, 2009). Behaviors that are transient and sporadic may be considered typical of certain stages of development; however, if the same behaviors become more frequent or intense, they may be

considered disordered (Gargiulo, 2009). Similarly, some behaviors that are characteristic of a particular culture may be misunderstood as disordered behavior by someone from another culture (Webb-Johnson, 2002). Disagreements notwithstanding, most professionals who work with students with EBD would agree on three general characteristics: inappropriate behavior, academic learning problems, and poor interpersonal relationships (Landrum et al., 2003).

Inappropriate behaviors fall into two categories: externalizing and internalizing (Heward, 2009; Lane, 2007). Externalizing behaviors are easily noticed acting-out behaviors, such as getting out of seat frequently, talking out during instructional time, refusing to follow directions, using profanity, arguing with peers and authority figures, damaging property, and fighting. Internalizing behaviors are less noticeable, are often overlooked by parents and teachers, and include being withdrawn and not engaging with other children, complaining of illness, and seeming to be anxious or depressed.

Most children and youth with EBD experience poor academic outcomes (Heward, 2009; Landrum et al., 2003) such as failing grades, and low graduation rates. This can be explained partly by the fact that many students with EBD have comorbid learning disabilities, or mild cognitive disabilities (Benner, Nelson, & Epstein, 2002; Forness, 2005), and partly by the fact that many students with EBD are identified only later in their school careers, which means that services have been delayed (Kauffman et al., 2007; Wagner, Kutash, Duchnowski, Epstein, & Sumi, 2005).

Difficulties caused by behavior problems are compounded when coupled with learning problems. Payne, Marks, and Bogan (2007) explain that behavioral problems and learning problems in children with EBD are reciprocal: Behaviors keep students with EBD from being fully engaged in instruction so they fail to learn the material. The content being taught builds

and becomes more difficult, and students with EBD become frustrated which spurs additional behavioral problems and disengagement. Eventually, students with EBD fall even further behind their peers academically, including those with learning disabilities (Anderson, Kutash, & Duchnowski, 2001). Because engagement leads to academic achievement (Dotterer & Lowe, 2011; Greenwood, 1991; Greenwood et al., 1984; Greenwood, Horton, & Utley, 2002; Wang & Holcombe, 2010), it is critical that students with EBD are engaged during instruction.

Another reason why students with EBD fail to make academic progress is the prevailing belief among educators that students' behaviors must be under control before they can receive instruction (Wehby, Lane, & Falk, 2003). It is true that obstreperous student behavior can derail lessons and disrupt the learning environment; however, effective instruction (Sutherland & Wehby, 2001), classroom management strategies (Cook, Landrum, Tankersley, & Kauffman, 2003; Mundschenk, Miner, & Nastally, 2011), and behavior management strategies (T. Scott, Park, Swain-Bradway, & Landers, 2007; Sugai & Horner, 2008) implemented in concert can lead to increased engagement and academic gains for all students.

Despite the fact that effective instructional and behavioral strategies have been identified (Burns & Ysseldyke, 2009; Kerr & Nelson, 2010), and the fact that all teachers encounter students with challenging behavior (Westling, 2010) either through specific individualized education plan (IEP) placement (Wagner et al., 2006), expected childhood and adolescent development, or because students with EBD are under identified (Kauffman et al., 2007), teachers report feeling unprepared to deal with students with challenging behavior (Heflin & Bullock, 1999; Westling, 2010), and they seldom use evidence-based practices that are effective for students with EBD (Burns & Ysseldyke, 2009; Cook et al., 2003; Stormont, Reinke, & Herman, 2011). This results in poor instruction and behavior management support for the

students who need it most if they are to close the achievement gap between themselves and their non-disabled peers (Cook et al., 2003).

Not just students with EBD, but all students benefit from teacher implementation of evidence-based instruction, and proactive instructional design (Basham, Israel, Graden, Poth, & Winston, 2010) that is responsive to individual learner strengths and preferences (Tomlinson, 1999) and promotes academic engagement. These are the hallmarks of Universal Design for Learning (UDL). UDL allows teachers to proactively plan for the inappropriate behaviors and learning needs of students with EBD rather than reactively responding to these issues. When teachers do so, students with EBD benefit from instruction and behavior management strategies that promote engagement and academic progress.

Universal Design for Learning

Architect Ron Mace coined the term universal design (UD), which refers to products and structures that are designed from the beginning to work effectively for as many users as possible (Edyburn, 2005; Jiminez, Graf, & Rose, 2007; Pisha & Coyne, 2001; S. Scott, McGuire, & Shaw, 2003; Story, Mueller, & Mace, 1998). This design concept became increasingly popular after the Americans with Disabilities Act (1990) was passed, and public places began to change to meet the needs of more users (Pisha & Coyne, 2001; Ralabate, 2011). Examples of universal design include automatic doors, zero entry swimming pools (i.e., beach entry swimming pool), and curb cuts. Automatic doors at the grocery store benefit customers with physical disabilities, and also customers who are carrying several bags of groceries. Zero entry swimming pools provide easy access for toddlers, the elderly, and also people with physical disabilities. Curb cuts benefit people who use wheelchairs, parents pushing strollers, and people exercising on rollerblades. In each of these examples, the design of the structure provides accessibility to

people with and without disabilities without the need for further accommodations to the structure or for the user.

Universal Design for Learning (UDL) is an adaptation of UD to the field of education and learning (Edyburn, 2010; Gargiulo & Metcalf, 2013; Orkwis & McLane, 1998; Rose & Meyer, 2009). It came about after the 1997 reauthorization of IDEA, which called for all students to have access to the general education curriculum (Edyburn, 2005; Erlandson, 2002). Although the IDEA does not define UDL in the current iteration, the amended definition provided for UD in the Assistive Technology Act of 1998 is referenced (IDEA Regulations, 34 CFR §300.44):

The term ‘universal design’ means a concept or philosophy for designing and delivering products and services that are usable by people with the widest possible range of functional capabilities, which include products and services that are directly accessible (without requiring assistive technologies) and products and services that are interoperable with assistive technologies (29 U.S.C. 3002 §3(19)).

IDEA calls for research and funding to support the use of universally designed technology in order to make the general education curriculum more accessible for students with disabilities (IDEA Regulations, 34 CFR §300.704(b)(4)(v); IDEA Regulations, 34 CFR §674(b)(2)(B)), and for states to use UD principles in the development and administration of assessments (IDEA Regulations, 34 CFR §612(a)(16)(E)). IDEA also references the National Instructional Materials Accessibility Standard (NIMAS), and instructs states to adopt the NIMAS so that students with disabilities can access instructional materials in appropriate formats (e.g., braille, audio, large print, digital formats).

IDEA is aligned with the No Child Left Behind Act (2001), which calls for all students, including students with disabilities, to meet specific proficiency standards on state achievement tests (Jiminez et al., 2007), and for the use of research-based practices (Thousand, Villa, & Nevin, 2007). UDL addresses both of these mandates simultaneously by promoting a flexible curriculum that meets the needs of a wide range of learners while incorporating evidence-based practices (Basham et al., 2010).

The Higher Education Opportunity Act (2008) provides a definition of UDL, which is the definition of the term as it appeared in the 1998 iteration of the Assistive Technology Act:

The term ‘universal design for learning’ means a scientifically valid framework for guiding educational practice that:

(A) provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills and in the ways students are engaged and

(B) reduces barriers in instruction, provides appropriate accommodations, supports and challenges and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient (20 U.S.C. 1001§102(a)(1)(24)).

Researchers and practitioners acknowledge the potential benefit of UDL on the basis of its implicit foundational principle of proactively applying sound instructional design (Coyne, Kame'enui, & Carnine, 2011; Orkwis, 2003).

The Center for Applied Special Technology (CAST; 2012), considered to be the leading authority on UDL (Klinger, Campbell, & Knight, 2009; Kurtts, Matthews, Smallwood, & Smallwood, 2009; McPherson, 2009; Meo, 2008), defines it as “a set of principles for curriculum

development that give all individuals equal opportunities to learn” (CAST, 2012). CAST aligns the principles of UDL with research that has identified three interconnected brain networks (Rose & Meyer, 2002; Rose & Strangman, 2007): the *recognition network* that enables the learner to identify and make sense of information and patterns, the *strategic network* that enables the learner to act upon the information and patterns, and the *affective network* that enables the learner to make emotional connections to the information and patterns. CAST posits that by providing multiple and flexible methods of representation, expression, and engagement, barriers can be minimized for students with disabilities and learning opportunities can be enhanced for all students (Rose & Meyer, 2002, pp. 74-75).

Central to most conceptualizations of UDL is the idea that the curriculum is made to be flexible so that it fits the strengths and preferences of a diverse group of learners rather than expecting the learners to adapt to a curriculum with rigid parameters (Edyburn, 2010; Hitchcock & Stahl, 2003; Lieberman, Lytle, & Clarcq, 2008; Rose & Meyer, 2002). In the implementation of a UDL-designed lesson plan, the teacher proactively designs instruction that incorporates the use of technology and evidence-based practices to make information more accessible to all learners (Basham et al., 2010).

For all students, including those with EBD, learning is maximized when they have access to evidence-based instruction and academic supports such as embedded strategy instruction (Berkeley, Marshak, Mastropieri, & Scruggs, 2011), and content enhancements (Bulgren, 2006; Dexter & Hughes, 2011). For students with EBD, learning is further supported with the use of effective classroom management strategies (Mundschenk et al., 2011; T. Scott et al., 2007), and instruction and support in the use of self-monitoring and self-management strategies (Grueasko-Moore, DuPaul, & White, 2006; Jull, 2009; Menzies, Lane, & Lee, 2009; Mitchem, Young,

West, & Benyo, 2001). When these supports are provided as a natural part of the learning environment (i.e., proactively planned), students with EBD are better able to meaningfully participate in the general education curriculum/classroom (Renzaglia, Karvonen, Drasgow, & Stoxen, 2003; T. Scott et al., 2007).

UDL provides a framework for designing instruction that is accessible to all learners in an inclusive classroom, including those with EBD, by providing integrated academic and behavioral supports.

Purpose

The purpose of this study was to examine the impact of UDL, implemented as a total framework, on the academic engagement of middle school students with EBD, and students who are at-risk for academic failure due to behavior problems, who are included in general education classes.

Research Questions

1. When provided with professional development on UDL and UDL lesson plan design, to what degree do secondary-level general education teachers design and implement UDL lessons with fidelity?
2. When compared with non-UDL treatment conditions, does the implementation of UDL in general education, secondary, inclusive classrooms result in increased academic engagement for students with EBD and/or students who are at-risk for academic failure due to behavior problems?
3. Do secondary-level general education teachers find UDL to be an acceptable treatment to improve the academic engagement of students with EBD and/or students who are at-risk for academic failure due to behavior problems?

CHAPTER 2

LITERATURE REVIEW

Universal Design for Learning

Universal Design for Learning (UDL) is a conceptual model for instructional design, emphasizing proactive planning of instruction that uses evidence-based strategies and technology to meet the individual needs of a wide range of learners. Although UDL has been discussed in professional literatures since the 1990s (Pisha & Coyne, 2001; Ralabate, 2011), and many researchers tout the benefits of UDL for all students (Basham et al., 2010; Gargiulo & Metcalf, 2013; Okolo, Englert, Bouck, Heutsche, & Wang, 2011), few empirical studies have examined the academic benefits of UDL for learners (Schelly, Davies, & Spooner, 2011) such as academic engagement. This may be the result of educators and researchers experiencing difficulty in understanding how to operationalize UDL, and how to measure the effects of UDL in the everyday classroom (Edyburn, 2009; Roberts, Park, Brown, & Cook, 2011).

UDL is typically mentioned in the literature with reference to one of two sets of guiding principles. Authors either adapt the architectural principles of universal design (UD; Story et al., 1998) directly to education (e.g., Acrey, Johnstone, & Milligan, 2005; Bernacchio & Mullen, 2007; Burgstahler, 2011; Erlandson, 2002; King-Sears, 2009), or they utilize the framework developed by David Rose and Anne Meyer which identifies the brain networks that are involved in learning, and applies instructional principles to maximize learning opportunities (e.g., Michael & Trezek, 2006; Orkwis & McLane, 1998; Ralabate, 2011; Rose & Meyer, 2002; van Garderen & Whittaker, 2006). The latter is most commonly used because it is based on extensive research, where the former is merely an application from one field of study to another.

The direct application of the architectural principles to education results in an ambiguous and impractical list of codes that are difficult to apply to education (Edyburn, 2010; Hitchcock & Stahl, 2003), and which get applied in different ways from study to study. For example, the fifth principle of UD, *tolerance for error*, refers to minimizing hazards and potential accidents (The Center for Universal Design, 1997). When researchers attempt to apply this principle to learning and instruction, the applications vary from providing prompt feedback to students such as with computer software programs (King-Sears, 2009), to designing instruction that is adaptable to individual learning pace and prerequisite skills (Scott, McGuire, & Shaw, 2003). While prompt feedback and adaptable instruction are appropriate in a UDL classroom, the architectural framework may leave practitioners and researchers unsure about how to consistently operationalize UDL in that setting.

The UDL framework developed by Rose and Meyer (2009) is the most widely used and accepted in the field of education (Abell, Jung, & Taylor, 2011; Basham et al., 2010; Blamires, 1999; Edyburn, 2005; Gargiulo & Metcalf, 2013; Metcalf, 2011). It is based on the work of Lev Vygotsky (1978) who identified three conditions for learning: (a) the learner must recognize patterns, (b) the learner must have strategies for acting on the perceived patterns, and (c) the learner must be engaged by the patterns and strategies being used to act on them (Pisha & Coyne, 2001). Rose and Meyer (2002) refer to these three structures as the recognition, strategic, and affective brain networks.

The recognition network identifies patterns, so a UDL application would involve using multiple and varied ways to help the learner recognize patterns; the strategic network plans and organizes how to act on perceived patterns, so a UDL application would involve teaching the learner how to use strategies when acting on the perceived patterns; and the affective network

regulates emotions and motivation, so a UDL application would provide the learner with choices in order to increase motivation and engagement when acting on the perceived patterns (Deubel, 2003; Rose & Strangman, 2007). Based on the identified brain networks, Rose and Meyer, and their colleagues at CAST developed principles and guidelines to help educators apply UDL in the classroom:

Provide multiple means of representation.

1. Options for perception.
2. Options for language, mathematical expressions, and symbols.
3. Options for comprehension.

Provide multiple means of action and expression.

1. Options for physical action.
2. Options for expression and communication.
3. Options for executive functions.

Provide multiple means of engagement.

1. Options for recruiting interest.
2. Options for sustaining effort and persistence.
3. Options for self-regulation (CAST, 2012).

These principles and guidelines are meant to prompt teachers to design instruction so that learners can access, engage with, and demonstrate understanding of information in ways that suit individual learners, but they may leave practitioners unclear about how to actually apply the principles of UDL in practice.

In an effort to make UDL more practitioner-friendly, James Basham and colleagues at the Universal Design for Learning - Implementation and Research Network (UDL-IRN; <http://udl->

irn.org/) re-worded the principles originally developed by CAST to convey the principles of UDL in simple and clear language that practitioners may more easily understand:

- Provide multiple means of representing or presenting information.
- Provide flexible methods for students to express understanding.
- Provide flexible ways for students to engage in the learning process

(UDL-IRN, “What is Universal Design for Learning,” n.d.).

If teachers are confused by CAST’s directive to *provide multiple means of representation* and what that might entail, they may more easily understand the UDL-IRN directive to *provide multiple means of representing or presenting information*. Both CAST and the UDL-IRN seek to convey the same point: The content of the lesson should be presented to students in a variety of ways so that barriers can be avoided. In order to do that, teachers should think about the content and come up with multiple ways to represent it (e.g., lecture, digital print, demonstration).

The collaborators at the UDL-IRN also identified critical elements of UDL instruction: set clear goals, intentionally plan for learner variability, incorporate flexible methods and materials, and conduct timely progress monitoring (UDL-IRN: Critical Elements of Instruction, Version 1.2, 2011), and steps for the instructional process: establish clear outcomes, anticipate learner variability, establish measureable outcomes and assessment plans, determine the instructional sequence/experience, and build in checkpoints for teacher reflection (UDL-IRN: UDL in the Instructional Process, Version 1.0, 2011). A synthesis of the principles developed by CAST and the practical wording and instructional design guidelines developed by UDL-IRN may provide a practitioner friendly starting point for educators to create UDL lessons, and for researchers to measure the impact of UDL.

To illustrate, consider the following example: Suppose a secondary biology teacher would like to conduct a lesson on cell division. In order to establish clear goals for the lesson, the teacher would make sure that the goals were aligned with appropriate standards and that he or she had a strong grasp of the goals and the desired learner outcomes. These steps would be true for traditional (i.e., transmission-style; Garrett, 2008) lessons as well, but what makes the UDL lesson different is that the goal would be separated from the means for achieving it (Rose & Meyer, 2009) in order to allow for flexibility in how students engage with the content to be learned. In the cell division example, a goal might be for students to demonstrate an understanding of the process of meiosis. Note that the goal does not include a means for achieving it such as an expectation for students to draw the phases of meiosis.

Planning for learner variability and incorporating flexible methods and materials are related. In order to plan to meet the needs of a diverse group of learners, the teacher would have to employ a variety of methods and make a wide array of materials available for students to use. In order to plan ahead for learner variability, the teacher would consider individual students' strengths and weaknesses, and anticipate where learners may encounter obstacles. By ferreting out the roadblocks ahead of time, the teacher can have a wide array of scaffolds prepared and in place in advance to meet the needs of all learners. In the cell division example, the teacher may provide text-to-speech software so that students with reading disabilities can listen as they read the textbook chapter on the topic or the teacher-provided handout. These digital versions of the textbook and handout may also contain hyperlinks to vocabulary definitions, diagrams, or short video clips that provide further scaffolding. The teacher may also provide a web-based animation or narrated tutorial of the process of meiosis with a simple web search using the key words *meiosis animation*, which yields numerous results (e.g., www.cellsalive.com). This

scaffolding may increase engagement for a student who struggles to maintain attention on the learning task at hand such as a student with EBD or ADHD. Not only would teachers plan for flexibility in how students engage with the material to be learned, they would also plan for students to have choices in how they demonstrate their knowledge.

Frequently assessing student understanding provides teachers with the necessary information to make instructional decisions. In the cell division lesson example, formative assessment or progress monitoring might reveal that a student misunderstood the sequence of the phases of meiosis. The teacher would use the information gleaned to alter the course of instruction or to make a decision to provide additional scaffolding for a specific student.

Empirical Support for UDL

Much of the literature on UDL includes scholarly reviews or expert opinions about how UDL can be implemented in K-12 classrooms (Howard, 2004; Hunt & Andreasen, 2011; Lieberman et al., 2008; McCoy & Radar, 2007; McPherson, 2009) or in university courses (Burgstahler & Cory, 2008; Gradel & Edson, 2009; Handle, 2004; Morra & Reynolds, 2010; Ofiesh, Rojas, & Ward, 2006; Orr & Bachman Hammig, 2009; Rose, Harbour, Johnston, Daley, & Abarbanell, 2006; S. Scott, McGuire, & Foley, 2003; S. Scott, McGuire, & Shaw, 2003), but few empirical studies exist that examine the impact of UDL on student engagement or academic achievement.

Researchers have reported on learning materials and technological applications that have been designed with UDL principles in mind (Marino, 2009; Okolo et al., 2011; Proctor, Dalton, & Grisham, 2007), assessment materials that have been altered to incorporate UDL principles (Acree et al., 2005; Johnstone, 2003; Stock, Davies, & Wehmeyer, 2004), and the training of teachers and university instructors in planning lessons that incorporate the principles of UDL

(Schelly et al., 2011; Spooner, Baker, Harris, Ahlgrim-Dezell, & Browder, 2007), but only a handful of studies have examined the impact of the commonly accepted principles of UDL implemented as a total framework (Browder, Mims, Spooner, Ahlgrim-Dezell, & Lee, 2008; Dymond et al., 2006; Friesen, 2008; Kortering, McClannon, & Braziel, 2008; Morrissey, 2008). Although the research on UDL to this point has resulted in more researchers and practitioners exploring the framework, more needs to be done in order to identify UDL as a research-based practice.

Research on UDL learning materials. Digital and electronic learning materials that have been designed with the principles of UDL provide students with scaffolds such as instantaneous audio and/or visual definitions of key vocabulary words, video representations of key concepts (Marino, 2009; Proctor et al., 2007), or direct links to supplemental documents, images, and video/audio files (Okolo et al., 2011) in order to support literacy and decrease cognitive load for students with learning disabilities. These learning materials incorporate the principles of UDL that promote access and engagement with information in flexible ways. By providing pop-up word definitions or video representations of complex concepts, learners have access to content that otherwise may not have been cognitively available to them if only presented in a print format. Proctor et al. (2007) found that when English language learners and struggling readers used comprehension-based embedded supports in the form of an avatar strategy coach, there was a positive correlation ($r = .41$) between the use of the support and gains in comprehension.

Research on UDL assessment materials. In studies that examined the impact of altering assessment materials in order to incorporate the principles of UDL, some researchers used the architectural principles (e.g., equitable, flexible, simple, and intuitive use) to design

study guides and/or written tests (Acree et al., 2005; Johnstone, 2003), while others used the CAST-developed framework (e.g., multiple means of representation, expression, and engagement) to develop internet-based assessments that included audio, video, and pictorial supports (Stock et al., 2004). Stock and colleagues (2004) found that youth and adult test-takers with intellectual disabilities were able to test more independently with UDL-developed internet based assessments than with paper and pencil assessments, but in both cases, the assessments did not represent UDL according the commonly accepted framework (e.g. flexible methods of presenting information, flexible methods of engaging with content, and flexible methods of demonstrating understanding), because all students would ultimately be administered the same assessment.

The architectural universal design principles may produce a well-designed paper test that will work well for a student who can demonstrate understanding via paper tests effectively, and the internet-based assessment may work well for a student who can demonstrate what they know effectively via a computer-based assessment with the supports that can be provided through the computer, but what is an appropriate form of assessment for one student may represent a roadblock for another student (Orkwis & McLane, 1998); this is why UDL promotes the use of flexible methods for students to demonstrate understanding.

Research on UDL professional training. Edyburn (2009) found that educators easily embraced the concept of UDL following training that included an overview of UDL and a rich discussion among colleagues and the professional development provider, but training on UDL that has incorporated more than an overview such as training on writing UDL lesson plans, or training on how to use various technology applications associated with UDL (e.g., digital textbooks), still has not yielded information on learner outcomes. Spooner et al. (2007) found

that pre-service and in-service educators could be trained to write lesson plans that incorporate UDL principles. In-service and pre-service teachers in the treatment group scored better on posttest after a one-hour training session on UDL than those in the control group who did not receive UDL training, but Spooner and colleagues (2007) did not take the study to the next step to examine lesson plan implementation or the impact of implementing the UDL lesson plans. Results of educator training on UDL at the university level indicate that UDL training for university instructors may increase the implementation of UDL principles in university courses (Schelly et al., 2011), but again, the impact of UDL implementation on student outcomes was not examined.

Research on UDL as a total framework. Only five studies were identified that reported to have implemented UDL as a total framework (Browder et al., 2008; Dymond et al., 2006; Friesen, 2008; Kortering et al., 2008; Morrissey, 2008). Academic outcomes were reported in one study (Browder et al., 2008), and alluded to in another study (Friesen, 2008). Three of the studies reported that students and teachers liked the differences that UDL brought to the learning environment (Dymond et al., 2006; Friesen, 2008; Kortering et al., 2008), and one of the five studies attempted to measure UDL implementation (Morrissey, 2008).

Browder et al. (2008) used task analysis in combination with UDL principles to increase responses of students with severe disabilities (i.e., IQ below 20). Teachers and interventionists created a set of questions such as, “Is there a better way to represent this step?” (i.e., multiple means of representing or presenting information), and “How can this response be prompted so the student learns the desired response?” (i.e., flexible ways for students to engage in the learning process), and “Is there an alternative way the student can more easily make the response?” (i.e., flexible method for students to express understanding) to ask when creating individualized plans

for increasing responses (p. 8). Using a multiple probe design, researchers found that all students increased responses when UDL principles were implemented.

Friesen (2008) implemented UDL in accordance with the commonly accepted framework by providing students with multiple, varied, flexible, and individualized ways to access, engage with, and demonstrate understanding of course content. Seventh grade students with and without disabilities participated in a geometry class that was designed, with UDL principles, to meet the needs of all learners. Students participated in the same tasks through multiple methods. For example, when learning about pi, diameter, and radius, some students worked with lengths of string or compasses while others used a software program. The teachers continually monitored student progress through on-going dialogues with students, and students were able to self-monitor their progress with the help of a teacher-designed rubric. The author reported that students had statistically significant gains in achievement from pre-test to post-test when UDL principles were implemented, but the methodology was not discussed, and data results were not summarized in the published article, and could not be obtained from the author.

Dymond et al. (2006) and high school staff members worked together to re-design two sections of a secondary-level science class which included at-risk general education students and students with disabilities. Although teachers did not receive specific training on UDL, the researcher/teacher team discussed UDL literature and addressed specific UDL related questions such as: “What are the general standards you are addressing in this unit/lesson?” (i.e., setting clear goals), “How will I provide instruction in a variety of ways?” (i.e., intentionally planning for learner variability), and “How will I provide students with choices related to materials, grouping, and teacher and self-directed learning activities?” (i.e., incorporating flexible methods and materials) when redesigning lesson plans. The qualitative study revealed, through pre- and

post-intervention interviews and weekly process interviews, and focus groups, that teachers and students had positive reactions to UDL implementation, but data on student academic outcomes were not collected.

In the previous three studies (Browder et al., 2008; Dymond et al., 2006; Friesen, 2008), researchers and teachers adhered to the central assumption of UDL: that learners are provided with options for engaging with and demonstrating understanding of information in order to maximize strengths and minimize weaknesses (Orkwis & McLane, 1998; Rose & Meyer, 2002). In contrast, Kortering et al. (2008) represents a non-example of UDL. Kortering and colleagues trained teachers to design *UDL interventions*. The interventions were to allow students to “access content information, engage in learning, and demonstrate their learning in ways that deviated from the traditional textbook or related format of assign, lecture, and assess” (p. 355). Ultimately, teachers in this study designed novel and engaging lessons, which were not demonstrations of UDL because all students engaged in the same learning activities. A key principle of UDL instruction is that learners engage with the content in a variety of ways. Additionally, Kortering and colleagues (2008) chose to separate students with disabilities from general education students during the UDL intervention lessons. This is contrary to the ultimate goal of UDL, which is to meet the needs of a wide range of learners in the same classroom.

Morrissey (2008) trained two teachers (i.e., treatment classrooms) in UDL and required them to include “at least one example of each type of flexibility in their lessons” (p. 80) during the treatment phase of the study, which measured teachers’ ability to implement UDL lessons and whether incorporating UDL elements into lessons as a secondary-level positive behavior support intervention would impact high school students’ on-time behaviors, attendance, and positive classroom behaviors (e.g., engagement). The researcher reported no differences

between treatment and control classrooms (which did not receive training on UDL) on UDL implementation and engagement. In fact, the researcher reported that in some instances, the control classroom teachers implemented UDL techniques with greater fidelity than treatment classroom teachers. This may be due to the tool that was used to measure UDL implementation (discussed below). This study, in addition to the Kortering et al. (2008) study, should caution researchers of UDL that in order to study UDL and its impact on learners, we must first operationalize UDL and find a way to measure it.

Research on UDL implementation fidelity measurement tools. Lacking a tool for measuring the implementation of UDL, researchers have employed existing tools such as the Individualized Classroom Environment Questionnaire (ICEQ; Abell et al., 2011), or researcher-created surveys (Kortering et al., 2008; Schelly et al., 2011) to gain insight into students' and teachers' perceptions of UDL-modified instruction. In the case of the ICEQ, variables such as the extent of personalization, student participation, independence in decision making, investigative problem solving, and differentiation were examined (Abell et al., 2011). While these attributes could all be included in an effective UDL lesson plan, the tool does not convey how UDL is implemented in a classroom. In the case of researcher-created surveys, participants were asked to respond to questions about the learning environment and various aspects of the instructional design (Kortering et al., 2008; Schelly et al., 2011). Even questions designed specifically to relate to the CAST framework (e.g., multiple means of representation) did not give an indication of how UDL is implemented in a classroom.

Morrissey (2008) employed a researcher-created UDL checklist for the purpose of measuring whether specific elements of UDL were implemented during classroom observations. This tool required the observer to mark whether UDL elements were evident or not evident

during a 20-minute observation. The researcher noted that this method resulted in some UDL elements being marked as not evident due to the timing of the observations (i.e., one time during baseline and once every other week during treatment), when the elements were actually evident at a time before or after the observation. Another limitation of the tool was that the technical language used (e.g., *alternatives to aversive levels of stimulation*, and *cognitive alternatives*) made it difficult for observers to score.

The previous research on UDL has not provided evidence to merit UDL being considered an evidence-based practice (Edyburn, 2010). In order for an intervention or model to be considered an evidence-based practice, there must have been multiple (i.e., minimum of four acceptable or two high quality) experimental or quasi-experimental studies with effect sizes significantly greater than zero (Gersten et al., 2005, p. 162). If the intervention or model is studied via single subject research methods, experimental control must have been established via multiple replications of experimental effect (i.e., five studies conducted by at least 3 different researchers). Additionally, the intervention and contexts must have been operationally defined, implemented with fidelity, and a functional relationship between intervention and dependent variable must have been documented (Horner et al., 2005, pp. 175-176). Without an agreed upon method of operation for UDL, and agreed upon measurement tool for UDL, and effective professional development in UDL, it will be impossible to determine if UDL implementation in the classroom has a positive impact on learner outcomes.

Professional Development

After graduating from their university programs, educators continue learning about their craft from a variety of sources including experiences in the classroom and within the school system (e.g., collegial collaboration, professional development opportunities). Borko (2004)

conceptualized these types of learning experiences as situational, which implies that as teachers participate in the various activities of their profession (e.g., teach classes, collaborate with colleagues, attend professional development activities), they become more and more competent, and knowledgeable in their subject area and general pedagogy. This is not to say that teachers become better at teaching just by teaching. Rather, it means that the activities in which a teacher engages should be orchestrated to promote teacher learning and growth.

Guskey (2000) defined professional development as “those processes and activities designed to enhance the professional knowledge, skills, and attitudes of educators so that they might, in turn, improve the learning of students” (p. 16). Unfortunately, professional development programs that are provided by states, districts, and schools are sometimes criticized as irrelevant, insufficient (Richardson, 2003), faddish, and lacking empirical support (Guskey, 2000). They often fail to provide the knowledge and skill development that educators need in order to produce positive student outcomes (Richardson, 2003). Teachers sometimes come to think of professional development as a way to meet the specified criteria for continued certification (Torff & Sessions, 2008), but place no value in it relative to their personal or professional growth (Guskey, 2000; Joyce & Calhoun, 2010).

Despite the fact that professional development in education is often criticized, improvements in education are unlikely to happen without it (Guskey, 2000). Guskey and Sparks (2002) proposed a theoretical model that describes the relationship between professional development and positive student outcomes: Content characteristics, (e.g., research-based interventions, new knowledge and skills), process variables (e.g., type and form including how activities are planned, organized, and implemented), and context characteristics (e.g., characteristics of the school culture, students, and educators), work together to determine the

quality of professional development, but it is the effect of professional development on teachers and administrators that impacts student outcomes. In other words, the occurrence of professional development alone does not improve student learning; educators' application of the new knowledge and skills is what makes the difference in student outcomes.

Professional development programs come in a wide range of configurations (Garet, Porter, Desimone, Birman, & Yoon, 2001) including what would be considered traditional professional development (e.g., workshops, conferences), study groups (i.e., professional learning communities; Roy & Hord, 2006), and reform type, or curriculum-linked, professional development that deals with issues such as instructional strategies, or applications of materials and assessment tools (Penuel, Fishman, Yamaguchi, & Gallagher, 2007). The reform type of professional development acknowledges initiatives such as the NCLB that specifically addresses the topic of professional development and the link between professional development and improved student outcomes. NCLB calls for schools to dedicate resources for "high quality" professional development to enable students to meet academic standards (Borko, 2004; Kratochwill, Volpiansky, Clements, & Ball, 2007), although it does not mandate what the professional development should include or how it should be provided.

Professional development programs also vary in duration and degree of collective participation (Garet et al., 2001). Short-term professional development activities may include workshops, in-service training, and conference sessions. Long-term professional development activities involve on-going contact with the professional development provider or members of the school district who have received extensive training in the intervention and serve as facilitators, or coaches. The degree of collective participation has to do with whether teachers

from the same department, grade level, school, or district participate in the professional development together, or if teachers attend professional development activities individually.

Researchers of professional development have asserted that long-term professional development is more effective than short-term professional development (Birman, Desimone, Porter, & Garet, 2000; Clark, Cushing, & Kennedy, 2004; Desimone, 2011b; Garet et al., 2001; Gersten, Chard, & Baker, 2000), and that collective participation promotes sustainability (Garet et al., 2001). Most concede, however, that the type of professional development should be a function of the content and activities to be included in the professional development (Garet et al., 2001; Guskey & Yoon, 2009), not something that should be determined by logistics.

Clark et al. (2004) provides an illustration of this point: Researchers implemented an Intensive Onsite Technical Assistance (IOTA) model to assist special education teachers in their efforts to facilitate inclusive education for secondary students with disabilities. The teachers were provided with workshops that included active learning and on-site follow-up support until they were able to implement the skills learned in the workshops with fidelity. The IOTA model ultimately improved the skills of the special education teachers, which positively impacted the quality of instruction received by the students. The specific content and features of the professional development (e.g., instruction on research-based strategies, and ongoing feedback) determined the type of professional development (e.g., reform, long-term) that was needed in order to produce positive outcomes.

Although often criticized, short-term professional development activities are deemed adequate when the goal of the professional development is to improve teacher knowledge or self-efficacy (Barton-Arwood, Morrow, Lane, & Jolivet, 2005; Guskey & Yoon, 2009). One-day workshops have been found to be an effective way of improving teachers' knowledge, and

perceptions of their ability to provide social skills training (Barton-Arwood et al., 2005) and academic accommodations (Kosko & Wilkins, 2009) for students with disabilities. H. Jones and Chronis-Tuscano (2008) found that not only did general and special education teachers improve their knowledge of ADHD as a result of a brief in-service training, but special education teachers increased their use of behavior modification techniques as well. Short-term professional development, although limited in contact hours, can still provide the core features of effective professional development.

Researchers agree on three core features of professional development: emphasis on content knowledge (i.e., directly related to subject matter and pedagogy), active learning (i.e., teacher involvement), and coherence (i.e., alignment with standards and other reform efforts) (Birman et al., 2000; Desimone, 2011b; Garet et al., 2001). The content of professional development activities can be directly related to the subject matter (e.g., how to teach fractions), or be more generally applicable (e.g., classroom management or lesson planning strategies). In the IOTA model study mentioned above (Clark et al., 2004), the content of the professional development for special education teachers included research-based strategies for inclusive education which was directly related to the work of the special education teacher who was attempting to facilitate inclusive education.

Active learning includes providing professional development participants with opportunities for observations of or by colleagues, classroom implementation of content learned during professional development, and options for analyzing student work (Desimone, 2011b; Garet et al., 2001), as well as opportunities for classroom experiences involving coaching and research inquiry (Boyle, Lamprianou, & Boyle, 2005). In the IOTA model study, teachers participated in active learning by having opportunities to implement the strategies they learned

during the workshop with the students in their actual classes. They then received feedback from the trainers on implementation, and conferred with them about strategies to improve implementation.

The alignment of professional development with current state, district, and school standards, assessments, curricula, and other reforms is paramount for effective professional development (Birman et al., 2000; Desimone, 2011b; Garet et al., 2001). In addition to coherence with standards, the professional development activities must be coherent with what teachers already know and have already learned in previous professional development activities. In the IOTA model study, coherence was ensured by the use of a measurement tool that incorporated interviews and observations to determine what teachers and school leaders considered important, and whether school programs were using research-based practices.

An additional component of coherence has to do with teachers collaborating on professional development activities. In the IOTA model study, the researchers served as coaches, but were referred to in the study as consultants. They worked with individual special education teachers who assembled teams of professionals (e.g., general education teacher, paraprofessional, related services faculty, and administrators) that worked together to help one student. The coaches conducted workshops with the teams, and then provided on-going, on-site, technical assistance for the special education teacher who was the team leader for each student case. The on-site assistance included conferences (i.e., discussions about research based strategies), performance modeling, guided practice with verbal cueing, and verbal feedback (Clark et al., 2004).

Coaching could be defined in education as one educator providing specialized, individualized, technical assistance to another where the coach is viewed as a colleague rather

than an evaluator, which sets a tone of collaboration. Joyce and Calhoun (2010) describe coaching as one professional development method under the umbrella category of personal/professional direct service models. Other methods under this model include mentoring, and whole school coaching as in the familiar literacy coach model, or an expert in a specific area coaching several teachers in one building or district (Joyce & Showers, 2002).

Professional development evaluation. Professional development must be evaluated in order to determine whether it is effective. Guskey (2000) suggests evaluating professional development on five levels: participant reactions, participant learning, organization support and change, participant use of new knowledge and skills, and student learning outcomes (p. 79-81). Data can be collected in each of these areas through various methods such as questionnaires, focus groups, interviews, observations, or student records. The data gathered would yield valuable information regarding the effectiveness of a professional development program, and what improvements could be made. In the case of on-going professional development, the data can provide information to guide its course. Providing effective professional development is often time consuming and expensive for school districts (Birman et al., 2000; Desimone, 2011a). If school districts have someone provide professional development at no cost to the district (e.g., university researchers), the districts still have expenditures such as substitute pay for teachers who are out of classes, or the cost of necessary supplies. Guskey and Yoon (2009) recommend implementing some professional development projects on a small scale (i.e., pilot study) before implementing them school-, district-, or state-wide.

This was the course of action taken by four states when implementing UDL initiatives (Muller & Tschantz, 2003). The states' professional development efforts ranged from disseminating information on UDL to educators via listserv, to sending administrators, teachers,

and technology specialists to CAST headquarters for two or three day training institutes. Kentucky, for example, began UDL implementation gradually by training selected teachers across the state in the production and use of digital curricula. Each of the states used either intensive two or three day institute training at CAST to train an initial cohort of educators, or used relatively little initial training on UDL and devoted the majority of their professional development efforts and resources on training teachers in the use of digital materials or technology. These small-scale efforts cost significantly less than implementing UDL on a full-scale state level, but may have resulted in teachers misunderstanding the concept of UDL, perpetuating misconceptions about UDL (Edyburn, 2009), or overlooking the enormity of what UDL has to offer.

UDL and Students with EBD

Students with EBD display inappropriate behavior, poor interpersonal relationships, and academic learning problems. Because their behaviors are often disruptive to the learning environment, students with EBD are excluded from general education classes at a higher rate than students with other high incidence disabilities (Handler, 2003). This is likely in part due to the fact that general education teachers have low self-efficacy regarding their ability to meet the needs of students with EBD in inclusive classes (Heflin & Bullock, 1999). While some students with EBD require intensive, individualized services that can only be provided in a special education classroom (Kauffman, Landrum, Mock, Sayeski, & Sayeski, 2005), some students with EBD might be better served in the general education classroom by maximizing their strengths, preferences, and interests to promote their academic engagement and success in the general curriculum.

Our current understanding of the academic and behavioral needs of students with EBD and students who are at-risk for academic failure due to behavior problems, suggests that UDL implementation in inclusive classrooms might be a way for teachers to improve the level of academic engagement, and subsequently academic achievement, for these students. Training and coaching teachers in the design and implementation of UDL could make it possible for teachers to write and implement UDL lessons which are accessible to all learners, including those with EBD, in an inclusive classroom. Finally, treatment fidelity data, collected by practitioners and researchers will be necessary in order to evaluate whether teachers are implementing comprehensive UDL lessons.

CHAPTER 3

METHODOLOGY

Experts on UDL have suggested that in order for it to be considered an evidence-based practice more research is needed on how UDL implementation impacts academic achievement and engagement, and how researchers and practitioners can measure its implementation (Abell et al., 2011; Basham & Gardner, 2010; Basham et al., 2010; Edyburn, 2010). This study used a multiple baseline across participants design to examine the impact of UDL, implemented as a total framework, on the academic engagement of students with EBD and students who are at-risk for academic failure due to behavior problems, who are included in secondary general education classes.

The research questions addressed in this study include the following:

1. When provided with professional development on UDL and UDL lesson plan design, to what degree do secondary-level general education teachers design and implement UDL lessons with fidelity?
2. When compared with non-UDL treatment conditions, does the implementation of UDL in general education, secondary, inclusive classrooms result in increased academic engagement for students with EBD and/or students who are at-risk for academic failure due to behavior problems?
3. Do secondary-level general education teachers find UDL to be an acceptable treatment to improve the academic engagement of students with EBD and/or students who are at-risk for academic failure due to behavior problems?

Setting

The study was conducted at two public junior high schools in an urban region of the Midwest. The instructional technologies available in individual classrooms were similar. In both schools, each classroom was equipped with a SMART Board™ and each classroom had access to classroom sets of laptop computers and/or a computer lab. School A had an attendance rate of 99.4%, and the class sizes ranged from 19-23 students per class. The school made adequate yearly progress (AYP) in reading, but not math for the 2011-2012 school year. School B had an attendance rate of 95.2%, and the class sizes ranged from 21-26 students per class. The school made AYP in reading and math for the 2011-2012 school year. The demographics for School A and School B are provided in Table 1.

Table 1

Demographic Information for Schools

Demographics	School A	School B
Enrollment		
Grades 5-8	366	422
Ethnicity		
Caucasian	44.8%	38.4%
African American	40.4%	48.8%
Hispanic	5.2%	0.2%
Asian	1.4%	1.7%
American Indian	1.1%	0.0%
Two or More Races	7.1%	0.0%
Socio-Economic Status		
Low Income Rate	55.2%	56.6%
Disability		
Students with an IEP	16.9%	19.0%

Note. Demographic information was obtained from the 2011-2012 school report cards.

The schools were chosen for convenience in addition to school administrator willingness to allow teachers to participate in the study. At each school, principals compiled a list of teachers who met the criteria for participation in the study. Those teachers were given a flyer encouraging them to meet with the researcher on a day when the researcher was scheduled to be present at the school (see Appendix A for the Teacher Recruitment Flyer). Three teachers at School A and two teachers at School B agreed to participate in the study.

All classes that were observed during this study were general education, core content classes (e.g., math, English, science) taught by teachers with general education certification. The classes included typical learners as well as students with disabilities and/or students who were at-risk for academic failure due to behavior problems.

Participants

This study included both teacher and student participants. For each teacher participant, there were one or two target student participants in addition to a classroom of non-target student participants. The teacher participant and target student participant pairs or groups remained the same throughout the study.

Teacher Participants

At each school, teachers of general education math, English, science, and social studies classes that included students with EBD or students who are at-risk for academic failure due to behavior problems were invited to participate in the study. Selection criteria included: (a) possess general education teacher certification for the subject area taught, (b) have a student with EBD or a student who was at-risk for academic failure due to behavior problems included in the target class, and (c) not be involved in any other formal on-going professional development

during the duration of the study. At both schools, teachers were provided with Continuing Professional Development Units from their school districts for participating in the study.

Detailed information about each teacher participant, including gender, age, level of education, teaching certification, years of experience, and current teaching assignment is included in Table 2. All teacher participant names have been excluded in order to maintain confidentiality.

Table 2

Demographic Information for Teacher Participants

Teacher	Gender	Age	Level of Education	Certification(s)	Years of Experience	School/Grade Target Class
A	Female	40	MS	Speech Pathology Elementary Ed. Administration	17	School B/8th Language Arts
B	Female	31	MS	Elementary Ed. Administration	7	School A/5th Math
C	Female	58	BS	Special Education General Education	25	School A/6th Science
D	Female	63	BS+16	Elementary Ed. Special Education	37	School B/8th Reading
E	Female	31	MS	Elementary Ed. School Counseling	7	School A/5th Science

Note. Information obtained from teacher participants.

Student Participants

At each school, target student participants were selected from students who were already enrolled in the teacher participants' classes. Selection criteria included: (a) have a special education eligibility of ED, other health impairment (OHI) for attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), or another disorder category

characterized by inappropriate behavior and difficulty in school due to behavior; or (b) be a general education student at risk for academic failure due to behavior problems.

Detailed information about each target student participant is included in Table 3. Information includes gender, age, grade, ethnicity, current grades in all classes, and explanations for failing grades (e.g., low test scores, or missing assignments). The disability eligibility category and the tools/method for reaching the eligibility determination (e.g., tests administered, physician diagnosis) is provided if the student was eligible for special education services. All student demographic and educational information was obtained through an examination of school records, including the students' special education files. Information on student participants, who were not eligible for special education, includes their current level of performance based on school records (e.g., grade reports, discipline reports). All target student participants' names have been excluded to maintain confidentiality.

Non-target student participants included all students in the teacher participants' classroom, who were not the target students, but who did return signed consent and/or assent forms. Non-target student participants appeared on video recordings, and data was collected on them for comparison purposes, but their school records were not examined. Students who did not return signed permission slips remained in the teacher participants' classrooms but were excluded from the study. Exclusion from the study meant that data was not collected on them, and they were excluded from the video recordings as much as possible. Complete exclusion from the video recordings could not be guaranteed due to the students remaining in the classroom to which they were assigned.

Table 3

Demographic Information for Student Participants

Student	Gender	Ethnicity	Age/Grade	GPA	Eligibility determination
A1	Male	African American	Age: 13.9 Grade: 8	1.2	OHI eligibility based on physician diagnosis of ADHD and Asperger's Syndrome School notes: Difficulty with organization. Office discipline referrals result from not being prepared for class and not completing homework.
B1	Male	Caucasian	Age: 11.4 Grade: 5	1.8	General education student at-risk for academic failure due to behavior problems. School notes: Difficulty with attention, and organization. Office discipline referrals result from lack of work completion and class disruptions.
B2	Male	Multi-racial	Age: 11.8 Grade: 5	1.2	General education student at-risk for academic failure due to behavior problems. School notes: Special education referral was implemented, but parents refused services. Above average IQ based on results from referral testing. Office discipline referrals result from continuous class disruptions and not completing in-class or homework assignments. Several suspensions from school (7 during the 10-week study).
C1	Male	African American	Age: 13.2 Grade: 6	1.4	Speech/Language Impairment eligibility based on WISC IV results, which indicated average non-verbal function, and extremely low verbal comprehension. School notes: Difficulty with attention, following directions, completing work and working independently. Office discipline referrals result from not completing homework.
C2	Male	Caucasian	Age: 12.6 Grade: 6	1.4	OHI eligibility based on physician diagnosis of autism, seizure disorder, OCD, and ADHD. School notes: Difficulty with attention, organization, reading comprehension, and social skills. Office discipline referrals result from not completing homework.
D1	Female	African American	Age: 13.9 Grade: 8	1.8	General education student at-risk for academic failure due to behavior problems. School notes: Difficulty with attention. Office discipline referrals result from disrespectful toward teachers and peers, and disruptive behavior during structured and unstructured settings.
E1	Male	African American	Age: 11.4 Grade: 5	1.0	ED eligibility based on BASC 2 rating scales and teacher reports. OHI eligibility based on physician diagnosis of ADHD. School notes: Traumatic home situation. Office discipline referrals result from profanity, physical aggression, and class disruptions. Several suspensions from school (8 during the 10-week study).
E2	Male	Multi-racial	Age: 11.8 Grade: 5	1.6	General education student at-risk for academic failure due to behavior problems. School notes: Difficulty with attention and following directions. Office discipline referrals result from class disruptions during instructional time.

Note. Information obtained from special education files and student records.

Measures

Independent and Dependent Variables

Academic engagement was the dependent variable in this study. Students were considered to be academically engaged when they demonstrated behaviors such as, writing, academic game play, reading aloud, silent reading, academic talk, answering questions, and asking questions (Greenwood, Hart, Walker, & Risley, 1994; Shapiro, 2011b). Because academic engagement leads to academic achievement (Dotterer & Lowe, 2011; Greenwood, 1991; Greenwood et al., 1984; Greenwood et al., 2002; Wang & Holcombe, 2010), it is critical that students with EBD are engaged during instruction.

The independent variables in this study were UDL professional development and UDL lesson implementation. UDL lesson implementation consists of proactively planning and implementing instruction that is accessible to a wide range of learners. UDL lesson implementation involves planning instruction, assessments, and learning activities that are varied, flexible, adjustable, and customizable so that learners can access, interact with, and demonstrate understanding of information in ways that allow them to maximize their strengths, interests, and preferences while minimizing their weaknesses (Rose & Meyer, 2002).

Instruments and Data Collection Procedures

Behavioral Observation of Students in Schools (BOSS). The Behavioral Observation of Students in Schools (BOSS; Shapiro, 2011b) was used to collect data on student academic engagement. The BOSS is an observation code that uses momentary time sampling and partial interval recording to examine student academic engagement and teacher directed instruction during classroom activities. The BOSS categorizes academic engaged time (see Table 4 for

codes) as either active engaged time (AET) or passive engaged time (PET), and off-task time as either off-task motor (OFT-M), off-task verbal (OFT-V), or off-task passive (OFT-P).

Table 4

Codes for the Behavioral Observation of Students in Schools (BOSS)

<u>Codes</u>	<u>Examples</u>
Active Engaged Time	<ul style="list-style-type: none"> • Writing • Reading aloud • Raising a hand • Talking to teacher/peer about assignment • Looking up a word in a dictionary
Passive Engaged Time	<ul style="list-style-type: none"> • Listening to/looking at instruction • Looking at academic materials • Reading assigned material silently
Off-Task Motor	<ul style="list-style-type: none"> • Out of seat not related to the lesson • Manipulating objects not related to the lesson • Touching others not related to the lesson
Off-Task Verbal	<ul style="list-style-type: none"> • Making audible sounds (e.g., whistling, humming) • Talking to peer unrelated to task • Talking to peer when prohibited by teacher • Making unauthorized comments/remarks • Calling out answers when prohibited by teacher
Off-Task Passive	<ul style="list-style-type: none"> • Working on unassigned activity • Looking around the room • Staring out the window • Listening to peers' unrelated talk
Teacher Directed Instruction	<ul style="list-style-type: none"> • Instructing whole class or group • Demonstrating academic material • Assisting individual student with assigned task

Note. Selected example items taken from: Shapiro, E. (2011). *Academic Skills Problems Fourth Edition Workbook*. New York, NY: The Guilford Press.

According to BOSS procedures, data are collected sequentially on a target student, peer comparison students, and the teacher by allocating every fifth interval for comparison peer and teacher behavior data. Data are collected for a predetermined amount of time (in this study, 30-45 minutes) divided into 15-second intervals. At the *beginning* of each interval, cued by an audible timer, the observer immediately records whether the target student is academically or passively engaged. If the target student is off task at the beginning of the interval, the engagement cells on the BOSS observation form are left blank. During the remainder of the 15-second interval, the observer watches only for off-task behavior. If off-task behavior is observed, at any time during the interval, a mark is placed in the appropriate cell. This means that engagement and off-task behaviors could both be indicated for the same interval. This process is repeated for each interval until the observer reaches the fifth interval. Every fifth interval, a comparison peer is observed, and cells are marked on the observation form in the same way as described for the target student. In addition to peer comparison data, teacher directed instruction data is also marked during the fifth interval. If the teacher is engaged in direct instruction at any time during the interval, a mark is made in the appropriate cell. If not, the cell is left blank. The observer returns to observing the target student for the sixth interval and this observation process continues for the duration of the observation.

The BOSS is scored by adding the number of times the target student, comparison peer, or teacher are engaged in each type of behavior and dividing by the total number of intervals recorded for each. Percentages are then calculated for the target student, comparison peers, and teacher for each behavior category (i.e., AET, PET, OFT-M, OFT-V, OFT-P and TDI). For example, in a 120-interval observation, the target student's behaviors will be recorded 96 times. If the student was actively engaged during 18 of those intervals, his or her percentage of active

engagement for that lesson would be 18%. During the same 120-interval observation, the comparison peers' behaviors would be recorded 24 times. If the comparison peers were actively engaged during 15 of those intervals, the percentage of active engagement for the peer comparison would be 63%.

BOSS data collection. For this study, BOSS data were collected via video recordings of classroom lessons. Each data collection session started at the beginning of a lesson and continued for 30-45 consecutive minutes. The 30- or 45-minute observation was divided into 15-second intervals for a total of 120-180 intervals. A modified BOSS observation form was used for this study because all off-task behaviors were coded as a single code, off-task (OT), in order to simplify the data collection process, and because the manner in which a student was off task was not important to this study (see Appendix B for the Modified BOSS Observation Form).

Observers began each data collection session by attending to the general information section at the top of the form, which was filled out by the researcher when the recordings were downloaded to the computer for viewing. The top of each form indicated the participants' designated identification (e.g., Target Student A1), the date of the video recording, the observer's name, the recording start time for the observation (e.g., 0h48m22s), and either written directions (e.g., begin with student behind the target student in the red shirt and move up and down each row in order) or a small diagram providing directions for peer comparison observations. When the video recording reached the indicated start time, the observer paused the video recording, set the interval timer, and then started both the video recording and timer simultaneously. The first interval was marked immediately and data collection continued for 120-180 intervals. During the 30 to 45-minute observations, lessons included teacher instruction, independent or group

work time, and other lesson-related activities. The observations were concluded when teachers ended the lessons, and percentages were calculated based on the observed intervals.

A secondary-level teacher was trained as a secondary observer for this study. Observer training consisted of instruction on the BOSS recording procedures followed by practice sessions where the primary observer (researcher) and secondary observer collected data from video recorded classrooms not related to this study. The primary and secondary observers practiced until they achieve 90% reliability for each code on three consecutive observation periods. The secondary trained observer then collected BOSS data on 34% of the lesson sessions in order to obtain a measure of inter-observer agreement. Coefficients of reliability on individual codes were calculated by dividing the number of agreements by the number of agreements plus the number of disagreements multiplied by 100 (Kazdin, 2003).

UDL Fidelity Tool. In order to measure the fidelity of UDL implementation for the present study, a UDL Fidelity Tool (UDL-FT) was created by the researcher based on a synthesis of the work of several UDL experts. The framework developed by CAST is the foundation of the fidelity tool, but work by James Basham, Michael Abell, and the Center for Innovation and Instruction for Diverse Learners, and the Montgomery County Public Schools in Maryland all informed and influenced the creation of the tool. James Basham and colleagues took the CAST principles and condensed and revised them for a more understandable framework (UDL-IRN, 2011). Michael Abell developed an instructional walk-through observation tool with a UDL emphasis where observers mark yes/no or always/sometimes/never for various elements of UDL. Categories on the walk-through tool include: curriculum materials, strategic engagement, affective expression, environment, assessment, and technology. The Montgomery Public Schools in Maryland developed a similar walk-through tool where observers would mark yes/no

to indicate whether certain elements were present. The elements, while aligned with UDL principles, were highly simplified and fell into two basic categories: student choices regarding products created, tools used, routines, work methods (i.e., partner work, group work), and teacher presentation flexibility (i.e., curriculum materials, explanatory devices, and graphic images). Neither of these tools was intended to identify comprehensive UDL implementation. As walk-through tools they were designed only to measure trends related to UDL implementation.

The UDL-FT was intended to identify comprehensive UDL implementation (see Appendix C for the UDL Fidelity Tool). The tool was based on the three principles of UDL identified by CAST: multiple means of representation, multiple means of action and expression, and multiple means of engagement. Each principle was broken down into three related elements written in the form of questions for practitioners to consider. Each element was further broken down into a numbered list of indicators (i.e., instructional techniques). Comprehensive UDL lesson implementation (i.e., implementation fidelity) was determined based on the indicators marked by the teacher. This is fully explained in the UDL-FT Scoring Tool section below.

Teachers completed the UDL-FT immediately following lesson implementation. For the use of this tool, and for this study, a *unit* was defined as a series of lessons relating to a single topic. A *lesson* was defined as all instruction or learning activities related to a specific component of a unit. For example, a language arts teacher may teach a unit on poetry, which includes a component on figurative language. The learning activities related to the component on figurative language would constitute the lesson, which may last one day, or span several days. Another teacher may decide, however, that within the figurative language component, more learning activities are needed on simile and metaphor and create lessons on these topics. What

each teacher considers a lesson varies from teacher to teacher, so for the purposes of this study, each lesson began with an introduction of new material and ended with an assessment (informal or formal) of the lesson objective.

When completing the UDL-FT, teachers considered the entire lesson and marked the indicators for each element that were present during the lesson. For example, when considering the first element, “*How was information represented during this lesson?*” a teacher would have thought about all the ways that information was represented during the lesson. The teacher may have begun the lesson with a lecture and PowerPoint that contained graphic images and video clips. Perhaps the next day, the teacher conducted a demonstration to illustrate the concept, and all through the lesson the teacher made students aware of (and showed students how to access) the digital textbook available on-line, and encouraged students to access it for additional support. The teacher in this scenario would have marked the indicators: orally, digital print, graphic images, video clip, demonstration, digital text, and information available outside of class. The teacher would have continued through the tool marking indicators under each of the nine elements. It was important for teachers to understand that indicators should not be marked arbitrarily. While the inclusion of some indicators may be incidental (e.g., the text book is available in a digital format), if they were not specifically made evident and available to the students during the lesson under consideration, they should not have been marked.

UDL Fidelity Scoring Tool. The UDL-FT was scored by the researcher according to the directions provided for each element on the accompanying scoring tool (see Appendix D for the UDL-FT Scoring Tool). The scoring tool provides explicit directions for the scoring of each element according to the indicators that are marked by the teacher and corroborated by the researcher. For each element, a zero is scored if the indicators that are marked indicate lack of

options, flexibility, adjustability or customizability. This is easily determined by the scoring tool directions that indicate what score should be given when certain indicators are marked. For example, if for element R1, “*How was information represented during this lesson?*” only indicators one, two, and three were marked (i.e., orally, digital print, and hardcopy print), the directions indicate to score zero for this element. A score of zero would be appropriate because representing information in oral and print-only format is not aligned with the UDL framework of representing information in multiple ways. If indicators one, three, and nine were marked (i.e., orally, hard copy print, and demonstration), the directions indicate to score a one for this element. A score of one would be appropriate because representing information orally, through hardcopy print, and through demonstration is moving in the direction of the UDL framework because multiple ways are provided for students to access the information. If indicators one, two, six, and fourteen were marked (i.e., orally, digital print, video clips, and available outside of class), the directions indicate to score a two for this element. A score of two would be appropriate because representing information orally, through digital print, through video, and making it available outside of class for students to access as needed is aligned with the UDL framework. Not only is the material represented in multiple ways, but also learners are able to customize when and how often they access it.

UDL Fidelity Tool data collection. For this study, teacher participants completed a UDL-FT form for each lesson implementation during each data collection phase of the study (i.e., baseline, training, treatment). Teacher participants completed the tool as soon as possible after each lesson in order to fill it out accurately based upon their recollection of the lesson implementation. The UDL-FT form, along with a copy of the lesson plan, and all printable materials included for the lesson were given to the researcher. The researcher used these items

in addition to video recordings of the lesson to corroborate the teachers' responses indicated on the UDL-FT.

Before scoring the UDL-FT, the researcher examined each element of the UDL-FT completed by the teacher participant in light of the corresponding materials provided by the teacher (e.g., lesson plan, hard copies of materials) and the corresponding video recordings for the lesson. Examining the materials provided and viewing the video recording corroborated the indicators marked by the teacher participants. Any items in question were discussed with the teacher participant for clarification. After corroborating the information contained on the tool, the researcher scored it as indicated above using the UDL-FT Scoring Tool.

UDL Professional Development Checklist. In order to verify that the training program was consistent across teacher participants, both the researcher and the teacher participant completed a UDL Professional Development Checklist (procedural fidelity checklist; see Appendix E) during the training session. The researcher and teacher participant checked off each training component on their individual checklists as it was addressed. Coefficients of reliability were calculated by dividing the smaller obtained score by the larger obtained score, multiplied by 100 (Kazdin, 2003).

Social Validity Survey for UDL. During the follow-up phase of the study, teachers were asked to complete a UDL Social Validity Survey (see Appendix F). The survey, created by the researcher, is based on the Treatment Acceptability Rating Form-Revised (TARF-R; Reimers, Wacker, & Cooper, 1991), which was designed to measure parents' acceptability of treatments used in clinical settings, and the Intervention Rating Profile-15 (IRP-15; Witt & Elliot, 1985) which was designed to measure acceptability of educational interventions. The TARF-R was used as a model because the questions addressed raters' understanding of the

treatment, raters' estimation of the magnitude of the problem, raters' thoughts on how the intervention fits with their established routines, and raters' thoughts about the time and monetary cost of implementing the treatment. The IRP-15 was also used as a model because, in addition to similar survey questions on the TARF-R, it also included raters' thoughts on whether other teachers would find the intervention useful, and whether the intervention is consistent with other interventions that teachers find acceptable. The items were rated by teachers using a Likert-type rating scale. Some survey items were reverse-scored so that high scores indicated positive feelings about UDL and low scores indicated negative feelings about UDL.

Procedures

Permission

Permission to conduct this study was obtained from the school administrators of each school, teacher participants (see Appendix G for Teacher Participant Consent Form), legal guardians of all student participants (see Appendix H for Parent/Guardian Consent form), and from Southern Illinois University Carbondale Human Subjects Committee. All students in each of the teacher participant classes were also asked to sign assent forms (see Appendix I for Student Assent Form).

Participant Selection

Teacher participants, in conjunction with the researcher, selected target students. First priority was given to students with a special education eligibility category of EBD, or similar disorder where behavior impacts academic progress. If there was not a student on the teacher's roster that met this criteria, a target student was selected who met the criteria for a student who is considered at-risk for academic failure due to behavior problems.

Phases

Pre-baseline. Prior to the start of the baseline phase of the study, the researcher met with each teacher participant once in their classroom before or after school to: (a) select one or two target student participant(s), (b) deliver parent consent forms and determine an appropriate reward for students for returning consent forms, (c) get consent form signed by the teacher, (d) determine, with the teacher, an appropriate arrangement for the video equipment, (e) train the teacher on how to set up and use the video equipment, (f) train the teacher on how to complete the UDL-FT, and (g) train the teacher on procedures regarding security of confidential information. Also, on a day prior to the start of the baseline phase of the study, the researcher visited each target class to meet the students, talk about the study, ask students to sign assent forms, and encourage students to return signed parent consent forms.

Baseline. Baseline data were collected for a minimum of three lessons and until steady pattern of responding was evident (i.e., UDL-FT scores consistently below 50%). Lessons were recorded with two video cameras in each classroom. The video cameras, Panasonic model #HC-V10, were placed on tripods in locations that captured both teacher instructional behaviors and student responses. At the start of each recording, the teacher made sure that the target student was within the frame of one video camera, and that the teacher location and majority of class, excluding the students who did not return permission slips, were within view of the other video camera. The teacher then conducted class as planned while making sure that the target student was within view of camera one. If, for example, the teacher had the students move to different desks to work in small groups, the teacher ensured that the target student remained in his or her seat and other students moved to join the target student's group. At the end of the class session, the teacher stopped the video recordings, removed the memory cards from the cameras, placed

them in the envelope provided by the researcher, and immediately hand delivered the envelope to the school office where it was locked in a file box until the researcher picked it up the next morning. When the researcher picked up the memory card in the morning, she left blank memory cards in an envelope for each teacher participant. Video recordings were downloaded onto the researcher's home computer each evening.

Each teacher participant lesson was assigned a code. All recordings and materials connected to that lesson were labeled with the same code. Each lesson had a corresponding lesson plan, lesson plan materials, class learning profile if used (explained below), UDL-FT form and UDL-FT scoring form, and two video recordings for each day of the lesson.

Video recordings were viewed at the conclusion of each lesson and data were collected on UDL implementation and student engagement. UDL implementation data were collected using the UDL-FT and accompanying scoring tool, and student academic engagement data were collected via the BOSS.

Treatment. Once teachers demonstrated a steady pattern of responding during baseline, one teacher participant from each school was selected to begin the treatment phase of the study while the other teacher participants remained in baseline. The treatment phase began with a professional development session on UDL and ended with a collaborative session on UDL lesson plan design.

The professional development sessions lasted approximately two hours, and consisted of an instructional segment and a collaborative segment. The instructional segment included the following components presented via PowerPoint slides: (a) UDL origin, (b) UDL conceptual underpinnings and related brain research, (c) UDL principles, (d) UDL and technology, (e) UDL and students with EBD, (f) UDL lesson plan design, (see Appendix J for the UDL Professional

Development PowerPoint Slides). During the collaborative segment, the researcher and teacher participant worked together to re-design one lesson plan to incorporate the principles of UDL. At the conclusion of the collaborative segment of the professional development, teacher participants had a comprehensive UDL lesson that was to be implemented on the next school day (day one of the treatment phase). During professional development, teachers were provided with copies of all supplementary materials used during the UDL training and collaborative session including: PowerPoint slides, UDL Lesson Plan guidelines, and the CAST Class Learning Profile.

The UDL Lesson Plan Guidelines (developed by the researcher; see Appendix K) helped the teachers systematically focus on all the important components of a UDL lesson plan. By following the backward design format (McTighe & Wiggins, 1999), teachers identified the desired results (i.e., goals), determined acceptable evidence (i.e., assessments), and planned learning experiences and instruction based on UDL principles. Each step of the lesson guidelines provides a guiding question and a checklist to follow in order to design a comprehensive UDL lesson. The guidelines were used during the collaborative segment of the professional development, and teachers were encouraged to continue using it throughout the study, but it was not required.

The Class Learning Profile (see Appendix L), a tool provided by CAST, prompts teachers to consider individual student strengths, weaknesses, interests, and preferences in light of each lesson or instructional unit. It serves as a starting point for teachers to develop multiple, flexible, learning experiences and activities in order to meet the needs of a wide range of learners in the class. The class learning profile tool was used during the collaborative segment of the

professional development, and teachers were encouraged to submit a completed class learning profile with each lesson plan, but it was not required.

If teachers' UDL implementation fidelity scores were low, or if they received a score of zero for any element on the UDL-FT Scoring Tool, the researcher provided additional professional development in the area of difficulty during coaching sessions.

Follow-up. Upon completion of the study, teachers were asked to complete the UDL Social Validity Survey (see Appendix F). It took approximately 15 minutes to complete the form. All teacher participants completed the form and returned it to the researcher.

Observer training. A responsible adult was trained as an observer for this study. Observer training consisted of instruction on the BOSS. In order to practice collecting data, the researcher and observer used video recorded classrooms not related to this study. The researcher and observer practiced until they achieve 90% reliability three consecutive times.

Security of confidential materials. At the beginning of each day, teacher participants collected envelopes containing memory cards from a locked box in the school office or directly from the researcher. Each envelope was marked with the teacher's name and date. At the end of each recorded class session, the teacher stopped the video recording, removed the memory cards from the cameras, placed them in the envelope provided by the researcher and immediately hand delivered the envelope back to the locked box in the school office. The researcher picked up the memory cards each morning.

Video camera memory cards that contained data were secured in a locked box in the schools' offices, and in the researcher's home. Video recordings were downloaded to the researcher's home computer and the researcher's external memory device in order to be transportable to be viewed by a secondary observer. The researcher and secondary observer

were the only ones to have access to the computer and memory device, and both were password protected. Computer files containing the video recordings and all camera memory cards were deleted, and all hard copy materials were shredded at the conclusion of the study.

Experimental Design

The majority of the current research on UDL includes expert opinions on how UDL can be implemented in K-12 classrooms (Howard, 2004; Hunt & Andreasen, 2011; Lieberman et al., 2008; McCoy & Radar, 2007; McPherson, 2009), or in university classrooms (Burgstahler & Cory, 2008; Gradel & Edson, 2009; S. Scott, McGuire, & Shaw, 2003), but few researchers have conducted empirical studies on actual UDL implementation and its impact on academic engagement. Of the studies that did examine UDL as a total framework, a variety of research designs were used including: multiple probe across participants design (Browder et al., 2008), experimental pre-test/post-test design (Friesen, 2008), constant comparative method qualitative design (Dymond et al., 2006), and quasi experimental between groups design with control and treatment groups (Morrissey, 2008). A multiple probe across participants design (John Cooper, Heron, & Heward, 2007) was not appropriate for this study because the research questions address the impact of UDL as a total framework rather than looking at the impact of specific UDL principles (i.e., representation, action and expression, engagement) on engagement. Likewise, an alternating treatments design (John Cooper et al., 2007) was not appropriate for this study because it would require teacher participants to switch from UDL lesson design and implementation to non-UDL lesson design and implementation repeatedly for a comparison of the effectiveness of two treatment conditions on students' academic engagement. Neither an experimental pre-test/post-test design nor a quasi-experimental design (Gay, Mills, & Airasian, 2009) was considered appropriate for this investigation because the unit of analysis was students

with disabilities in general education classrooms at the secondary level, and the number of research subjects necessary for such designs was beyond the scope of this study.

A multiple baseline across participants design (John Cooper et al., 2007) was used for this study. In a multiple baseline across participants design, baseline data are collected on two or more participants in the same setting. After baseline data show a predictable pattern of responding for each participant, the intervention is applied to the first participant. After the first participant intervention data show a steady pattern of responding, the intervention is applied to the second participant and subsequent participants are introduced to treatment conditions in a staggered fashion over time. Although multiple baseline across participants designs are typically conducted in the same setting, John Cooper et al. (2007) suggest that a multiple baseline design can be conducted across different subjects in different settings such as different classrooms. They provided a hypothetical example where data might be collected on different teachers in different classrooms following specific training. The authors note:

even though the different subjects (teachers) are all behaving in different environments (different classrooms), comparison of their baseline conditions is experimentally sound because the variables likely to influence their teaching styles operate in the larger shared environment in which they all behave (the school and teaching community). (p. 217)

Cancio, West, and Young (2004) used a multiple baseline across subjects design to examine the impact of a parent-assisted self-management program for homework completion. In this study, the intervention was implemented partially in students' individual homes by parents, but the immediacy and magnitude of change from baseline to treatment condition along with the number of participants indicate that the intervention was effective for increasing student homework accuracy and overall math achievement. Strain, Wilson, and Dunlap (2011) used a concurrent

multiple baseline across participants design to examine the effects of prevent-teach-reinforce, a model for behavioral support. In this study, different teachers in different classrooms implemented the intervention. Rapid decreases in problem behavior and increases in engagement demonstrated that the intervention was effective.

Data Analysis

Data collected for each lesson was charted using Microsoft Excel software. Graphs show academic engagement scores for student participants for each day of each lesson (with the exception of days when students were absent from the classroom), and a cumulative single UDL lesson implementation score for each lesson implemented. For example, if for one teacher participant, lesson one lasted one day, lesson two lasted two days, and lesson three lasted one day, the graph would show four data points for the target student's academic engagement and three data point *sets* for UDL lesson implementation (e.g., one data point for lesson one, a two-data points *set* with the same score for lesson two, and one data point for lesson three).

A visual analysis of the data was conducted according to recommendations by Horner et al. (2005). Level, trend, and variability of data points were interpreted as well as the immediacy of the effect following the onset of the treatment, the proportion of data points that overlap from baseline to treatment condition, the magnitude of changes in the dependent variable (engagement), and the consistency of data patterns across participant dyads. Graph were constructed for each teacher participant separately to show UDL implementation fidelity, and for each teacher-student participant dyad to show student academic engagement along with UDL implementation. Graphs were aligned to show the staggered introduction of the intervention.

Percentages of non-overlapping data (PND; Scruggs, Mastropieri, & Casto, 1987) were calculated to determine the effectiveness of the UDL training. Percentages were calculated by counting the number of data points in the treatment phase that were higher than the highest data

point in the baseline phase and dividing by the total number of data points in the treatment phase, then multiplying by 100 (Scruggs et al., 1987). PND scores over 90% are considered very effective, 70-90% are considered effective, 50-70% are considered questionable, and less than 50% are considered ineffective (Scruggs & Mastropieri, 1998).

CHAPTER 4

RESULTS

This single subject multiple baseline across participants study had three purposes. The first purpose was to determine to what extent secondary teachers design and implement Universal Design for Learning (UDL) lessons with fidelity following professional development and ongoing coaching on the principles and practices of UDL. The second purpose was to examine the impact of UDL lessons on the academic engagement of students with EBD, and on students who are at risk for academic failure due to behavior problems, but who are included in general education middle school classes. The third purpose was to determine whether secondary teachers find UDL to be an acceptable treatment for improving academic engagement for students. Results for each research question are addressed separately in this chapter.

Teachers' Implementation of UDL Lessons

Research question #1: When provided with professional development on UDL and UDL lesson plan design, to what degree do secondary-level general education teachers design and implement UDL lessons with fidelity?

After a minimum of three sessions in the baseline phase, teachers were individually trained on UDL due to the multiple baseline across participants design, in which treatment is introduced in a staggered fashion (John Cooper et al., 2007). The initial training sessions lasted approximately two hours and consisted of an overview of UDL, a discussion about how UDL can address behavioral concerns, and a discussion about UDL lesson plan design. The training sessions ended with a collaborative lesson planning session during which the researcher and the teacher modified all or part of the teacher's next lesson in order to transform it into a UDL lesson. The collaborative lesson planning session was a key component of the UDL training

because it gave teachers an opportunity to immediately apply the new information with the support of the researcher, and earlier research has shown that professional development that allows for teachers to bring into practice a new skill or process with their own class is more meaningful (Birman et al., 2000; Desimone, 2011a; Garet et al., 2001).

After the initial two-hour individual training and collaborative lesson planning session, training continued in the form of coaching on a regular basis. Joyce and Showers (2002) describe coaching as a direct service model of professional development in which teachers develop greater expertise with a new skill, and practice the new skill more frequently and for a longer duration than when coaching is not part of the professional development. Hence, the researcher met with teachers individually each morning before school (an exception was Teacher A who was rarely present as early as the researcher, so coaching was accomplished via email, text messages, and phone calls). During these morning coaching sessions, teachers were encouraged to ask questions and the researcher brought up specific concerns based on recent observations of recordings. A morning coaching session often consisted of the researcher asking the questions, “How is your next UDL lesson plan coming along?”, “Can you think of more ways to present the information on the current lesson?”, or “How can you support self-regulation skills for the target student?” During these sessions, the researcher also addressed logistical issues such as camera adjustments.

UDL implementation was measured via the Universal Design for Learning-Fidelity Tool (UDL-FT; see Appendix C). The UDL-FT, which is described more fully in Chapter Three, was designed to measure UDL implementation fidelity over an entire lesson. Teachers filled out the three-page form after completing each lesson throughout all phases of the study. Lessons ranged from one day to five days depending on the teacher and the nature of each lesson. Teacher A, for

example, conducted several short grammar lessons (gerunds, participles, infinitives) that were part of a larger unit on verbals, and some longer lessons that were part of a unit on career exploration and research.

Teachers submitted the completed UDL-FT forms to the researcher and the researcher scored them with the UDL-FT Scoring Tool (see Appendix D) following completion of video recorded observations. If there were discrepancies between a teacher's self-evaluation on the UDL-FT and what the researcher observed, the teacher was contacted for clarification. In all cases, discrepancies were found to be a result of teachers marking elements that were not included in the lessons or failing to mark elements that were included in the lessons. A common error, for example, involved teachers marking, *Information was readily available for learners to access in advance*, or *Information was readily available outside of class for learners to access independently and/or repeatedly*, when this was not evident on the recordings. When asked for clarification, teachers reported that they thought the students' textbooks would render these elements achieved despite contrary discussion during the training.

Each principle of UDL (i.e., multiple means of representation, multiple means of action and expression, and multiple means of engagement) is represented on the UDL-FT, is broken down into three elements, and is further divided into several potential indicators. The list of indicators in each section is not all-inclusive, so each section also contains a line for additional indicators to be inserted. Each list of indicators contains examples of practices that could be considered *not UDL*, *toward UDL*, and *comprehensive UDL*. For example, in the first principle (multiple means of representation), element two (support for understanding), indicator one says: *learners were left to their own devices to understand information as it was represented*, which illustrates a practice that is not UDL. Indicators two and three, *structure of current text*

explained, and *vocabulary was pre-taught*, represent practices that are moving toward comprehensive UDL practices. Indicators four through ten (e.g., *embedded vocabulary support* and *decoding support via text-to-speech software*) represent supports that allow students to customize their own learning, which is comprehensive UDL. When UDL is implemented comprehensively (i.e., with fidelity), learners are provided with the means and opportunity to customize how they interact with the material to suit their learning strengths and preferences (Orkwis & McLane, 1998; Rose & Meyer, 2009). Scores of zero (not UDL), one (toward UDL), and two (comprehensive UDL) were assigned for each element according to the level of UDL that was indicated by the teacher and corroborated by the researcher via recorded observations. Scores were totaled, divided by 18 (highest possible score), multiplied by 100, and rounded to the nearest whole number to produce an overall UDL score in the form of a percentage, which was plotted on a graph.

If it became evident that teachers were having difficulty during the treatment phase of the study, they were provided with coaching related to the specific component of UDL that was giving them problems. Teacher A, for example, began the treatment phase of the study with low scores in the area of multiple means of representation. Coaching was provided in this area and scores increased.

All teachers in this study improved their UDL implementation following initial training sessions. A visual inspection of the UDL data reveals a significant increase in level from the baseline phase to the treatment phase with zero overlapping data points for four of the five teachers (see Figure 1). Kazdin (1978) noted that when performance during the treatment phase does not overlap with performance during the baseline phase, effects are to be considered reliable (p. 637).

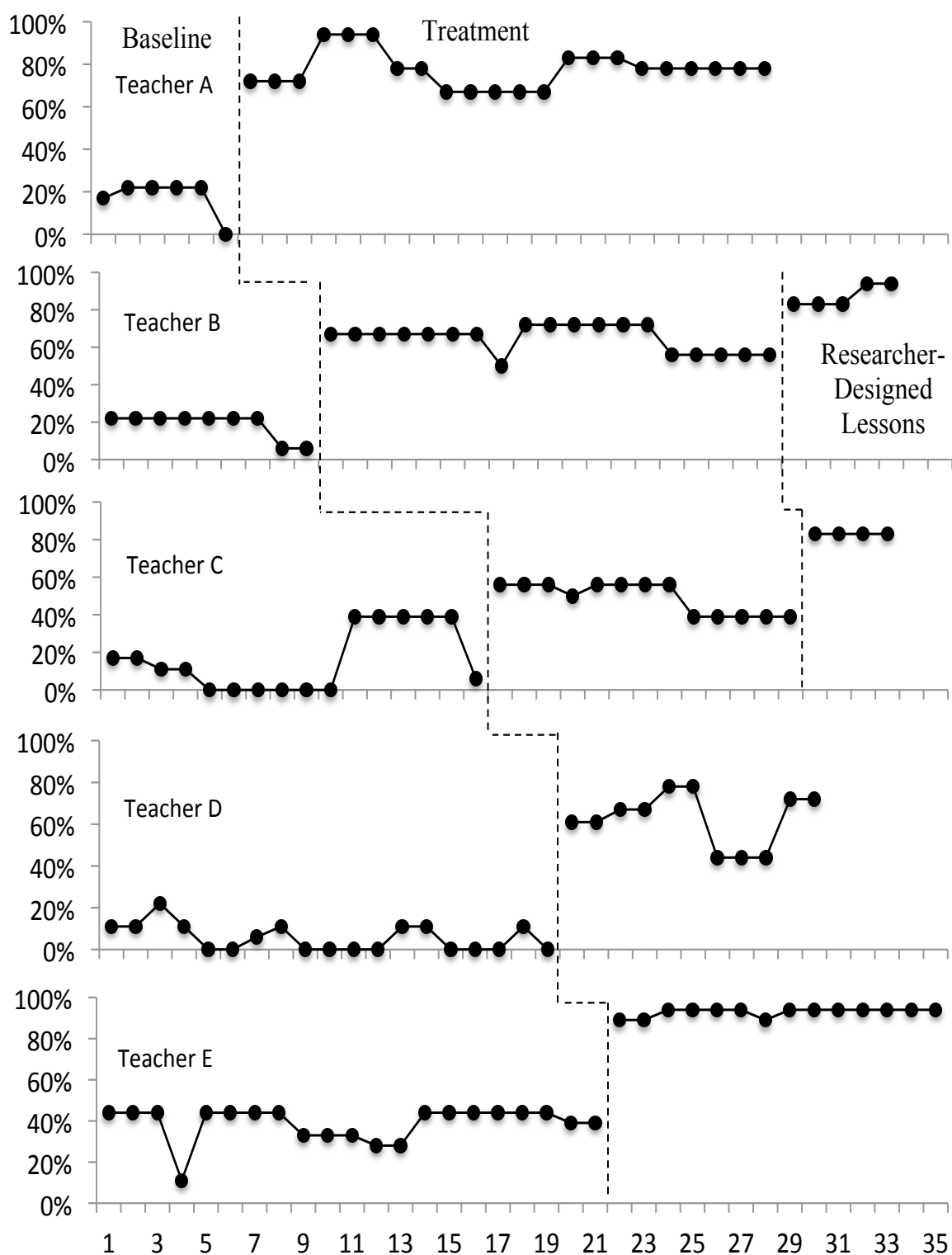


Figure 1. UDL Implementation Fidelity Scores for All Teacher Participants

Percentages of non-overlapping data (PND; Scruggs, Mastropieri, & Casto, 1987) were calculated to determine the effectiveness of the UDL training. PND calculations for the present study revealed that the UDL training and coaching was very effective for four of the five teachers (A, B, D, and E; 100% PND), and questionable for one teacher (C; 61% PND).

In addition to low mean performance during the baseline phase paired with significantly higher mean performance during the treatment phase, internal validity is also indicated by the absence of positive trends during baseline, and the increase in level from baseline to treatment phases (see Figure 1). Data during the treatment phase were expected to increase as a result of the intervention. The fact that the baseline data remained low without an increasing trend further bolsters internal validity (Byiers, Reichle, & Symons, 2012; Gast, 2010). Similarly, internal validity was again established because each teacher participant's baseline scores demonstrate a scarcity of UDL principles in use followed by an immediate and significant increase in UDL principles in use (with the exception of Teacher C). This shows that the difference from baseline to treatment phase is a result of the UDL training and coaching provided as part of the study, and that the training allowed the teachers to make an immediate change in their instruction.

In the following section, each teacher participant's UDL scores are displayed in individual line graphs for closer examination (see Figures 2, 4, 6, 8, and 10). Red data points highlight additional coaching sessions discussed below. Additionally, each teacher's UDL score has been broken down into the three principles of UDL and further divided into three elements for each principle as indicated on the UDL-FT. The bar graphs (see Figures 3, 5, 7, 9, and 11) allow for a visual analysis of growth between phases of the study for each teacher separately, and later, in Figure 12, as a group. The graphs also make it easy to see which UDL elements seem to be most difficult for teachers to implement.

In order to accurately interpret the UDL element scores, it is important to recall what each one means:

Multiple Means of Representation (R)

- R1: Information is represented in multiple ways.
- R2: Understanding of information is supported (e.g., symbols are explained).
- R3: Comprehension of information is supported (e.g., key concepts are highlighted).

Multiple Means of Action and Expression (AE)

- AE1: Learners interact with information in multiple ways.
- AE2: Learners express knowledge/mastery of information in multiple ways.
- AE3: Executive functioning is supported.

Multiple Means of Engagement (E)

- E1: Interest is supported.
- E2: Effort is supported.
- E3: Self-regulation skills are supported.

Teacher A

The mean UDL scores for Teacher A were 18% during the baseline phase and 78% during the treatment phase (see Figure 2). During baseline, Teacher A implemented four lessons related to a unit on research and writing. Each student conducted research on the same topic (fast food) and typed a five-paragraph essay to report his or her findings. During the treatment phase, Teacher A implemented nine lessons: four related to a unit on grammar and five related to a unit on research and writing, in which each student conducted research on a career of his or her choice, typed a five-paragraph essay to report the findings, and presented his or her topic to the class by means of oral presentation and a visual aide.

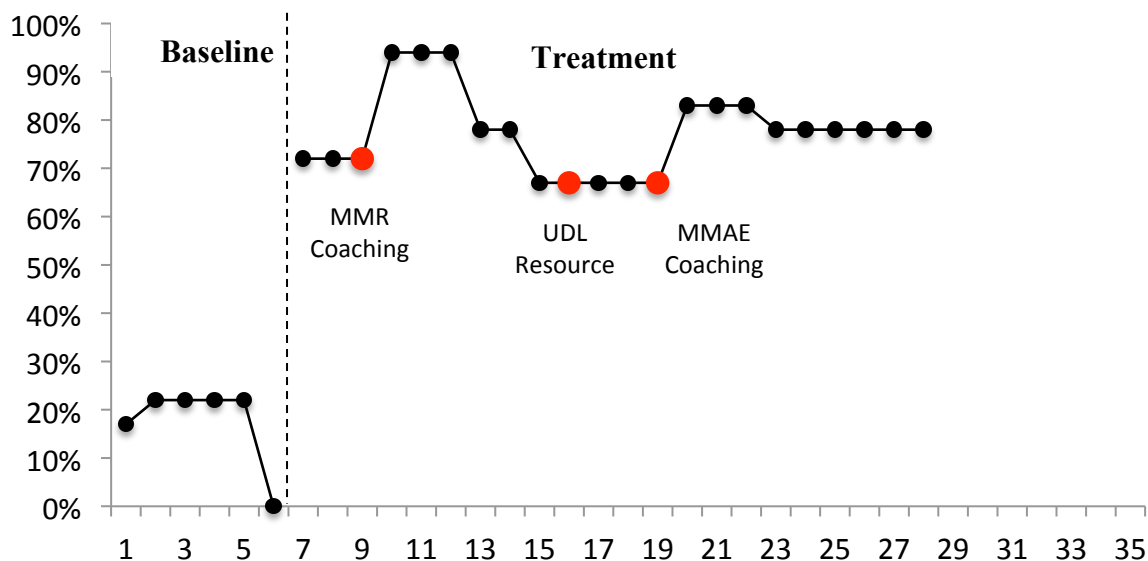


Figure 2. UDL Implementation Fidelity Scores for Teacher A

During baseline, Teacher A's UDL principle element scores (see Figure 3) ranged from .0 to .83 on the 2.0 scale, which indicates that during baseline, Teacher A did not consistently design and implement lessons that were aligned with UDL principles. Baseline lessons were related to research and writing. All students were to research and write about the same topic (fast food). Information was represented through lecture and print with the exception of one lesson where images of fast food were displayed on the SMART Board to prompt a discussion about the topic (R1). During each day of the lesson, Teacher A used discussion to help students to activate their existing knowledge on the topic, and also to spark interest (R3 and E1). The assignment was broken down into smaller steps (e.g., research, pre-writing, writing) to help students manage the project (AE3). Reviews were provided to help students monitor their progress and maintain effort (AE3 and E2), and helpful tools and materials (e.g., graphic organizers for pre-writing) were supplied to support comprehension (R3). The value and importance of the assignment (e.g., learning about healthy eating in addition to further

development of research and writing skills) was discussed regularly to maintain interest (E1) and effort (E2).

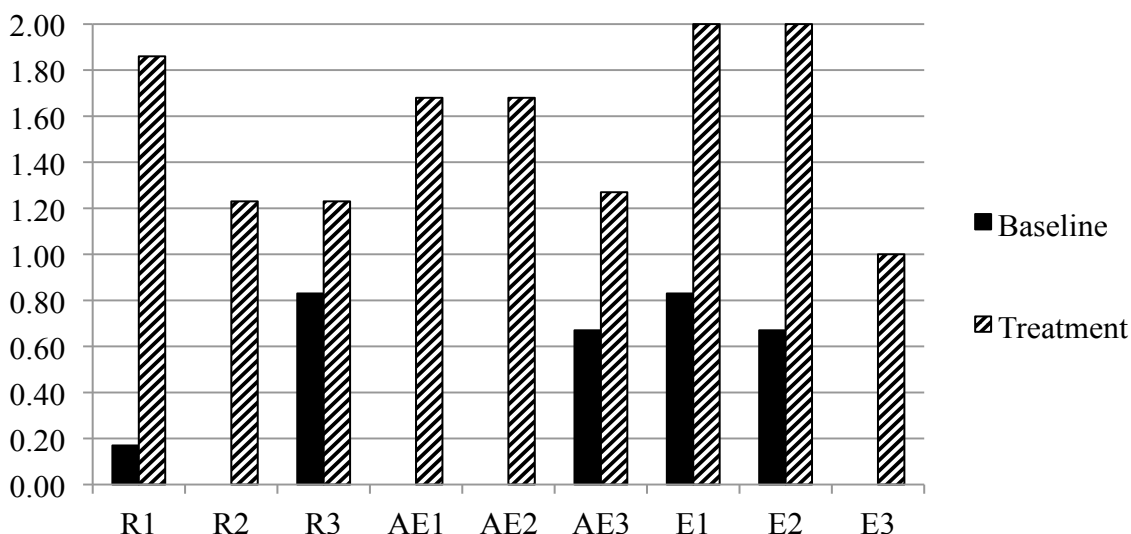


Figure 3. UDL Principle Element Scores for Teacher A

Despite the supports that were provided during the baseline lessons, these lessons would not be considered UDL lessons for several reasons: information was rarely represented in ways other than print and lecture (R1), supports were not provided for understanding (R2), students were not provided with options for learning activities or assessments (AE1 and AE2), executive functioning skills (AE3) were not supported beyond general classroom management prompts, and self-regulation skills (E3) were not supported. More importantly, none of the supports that were provided were customizable, which is what is required for a lesson to be considered a comprehensive UDL lesson.

During the treatment phase, Teacher A improved over baseline in all areas of UDL (see Figure 3) with UDL principle element scores ranging from 1.00 to 2.00, which indicates that during the treatment phase, Teacher A designed and implemented some lessons and parts of lessons that were at or approaching a comprehensive level of UDL. Two of Teacher A's lessons were lacking UDL principles. In one lesson, the principle of multiple means of representation

was not adequately addressed. Information was only provided in the form of print and lecture (R1), and no supports were provided for understanding and comprehension (R2, R3). Coaching was provided on these elements, which resulted in increased UDL scores for the next lesson (see Figure 2). In a second lesson, supports for understanding and comprehension (R2, R3) were not addressed comprehensively and options were not provided for learning activities and assessments (AE1, AE3). This lesson spanned five days, and the only opportunities for choice were when students were allowed to choose which page of a homework packet they wanted to have graded on one occasion, and whether they wanted to complete a worksheet or create a puzzle (similar to the worksheet) on another occasion. These types of options do not allow for students to maximize their strengths and minimize their weaknesses, as articulated in element AE1: *learning experiences were aligned with learner strengths, interests, and preferences as indicated on the class learning profile*. Teacher A reported having no time to look for ideas on other ways to provide students with options. A UDL Resource Packet (see Appendix M) was provided so that the teacher would have more UDL ideas and tips without having to look for them. This resulted in no change during this lesson (see Figure 2), but additional coaching on the principle of multiple means of action and expression was provided which resulted in improved UDL scores for the duration of the treatment phase (see Figure 2).

During the treatment phase, Teacher A implemented several practices that are aligned with comprehensive UDL. In addition to lecture and print, grammar lessons were presented via interactive SMART Board activities (R1). Understanding and comprehension were supported with the use of low-tech (i.e., no computer required) and high-tech (i.e., computer and Internet required) customizable supports (R2 and R3). The low-tech support was a handout that students could choose to take or not take. It contained examples from the grammar unit with answers on

the back so students could check their understanding (AE3). The high-tech support was a list of websites where students could practice the grammar skills on their own. Students were also provided with choices for learning activities (AE1). Following the teacher-directed portion of the lesson, students could choose to work individually or with a partner to complete a worksheet, or take a practice quiz on the computer (www.quia.com). If they chose the computer option, they would be able to take the quiz multiple times to achieve a high score. For homework, students were allowed to choose from three sections of a worksheet packet. The teacher explained that the sections were increasingly more difficult and that the students could choose the level of difficulty they felt was appropriate based on their level of understanding of the concepts (AE3). Not only did this allow for students to customize the learning activity (AE1) and assessment (AE2), it also allowed students to reflect on their learning (AE3). The teacher was pleased with the choices that students made. Rather than choosing the “easy” option as one might expect, students chose options that provided adequate support and challenge.

Most of the treatment phase involved lessons related to a research and writing project. During this unit, students were to research a career they were interested in, write an essay about the career, and conduct a presentation for the class, which included a visual aid. As a result of the UDL training, Teacher A decided to veer slightly from the lesson as it was previously written and implemented, and allow students to have more choices in certain areas of the assignment. Students first took an interest inventory that provided them with a list of careers that met their criteria. Then, they selected the career option that interested them the most and began to research that career in depth. They were allowed to gather information from the computer, from books, from interviews, or from other sources approved by the teacher (R1 and AE1). All essays had to be typed, but students had options for their visual aid that would be part of the assessment

for this project (AE1 and AE2). Visual aides could be posters, PowerPoint presentations, props, demonstrations, or any other visual element approved by the teacher. Each day, the teacher continued to support understanding and comprehension (R2 and R3) by demonstrating how to access and maneuver various websites (e.g., Bureau of Labor Statistics Occupational Outlook Handbook: www.bls.gov/ooh/) and by previewing various books (R1). The teacher also invited a guest speaker to talk about his job in the entertainment industry (R1). The daily introductions of additional sources helped to maintain student interest (E1), and the accompanying prompts for the task process (e.g., “You should be finishing your introduction today.”) helped students to maintain effort and manage their time (E2 and AE3). As the project got underway, Teacher A also had students engage in shorter lessons where all students did the same thing. These lessons gave students the opportunity to explore career options that were different from their particular interests. Information for these lessons was represented via video clips (R1), and by having students meet with peers (AE1) to share career interests.

Teacher A did make more of an effort during the treatment phase to help students manage their own learning (i.e., executive functioning) and behavior (i.e., self-regulation), but it was mainly through general classroom management strategies. Assignments were broken down into smaller parts with deadlines, and students were encouraged to reflect on their own learning, but no *customizable* supports for self-regulation (personal behavioral goals; E3) or executive functioning (personal learning goals; AE3) were provided for the target student or any other students. Target Student A1 did not demonstrate overt, acting out behaviors that required discipline measures, but was frequently off task daydreaming or attending to something other than the task at hand. Despite suggestions offered during coaching sessions on self-regulation (e.g., soft alarm set to regular intervals so the student could self-monitor his on-task behavior),

and executive functioning (e.g., setting a goal, making a checklist; Zimmerman, 1998), the teacher only occasionally prompted him to return to the task. A central premise of UDL is that supports are universally designed to benefit all learners (Edyburn, 2005), which means that supports are available for students to access as needed. Target Student A1 (and some non-target students) may have benefitted from these types of supports had they been made available.

The modifications that Teacher A employed in order to meet the UDL criteria were generally not time intensive. They included additions to previously established lesson plans such as a web-based quiz (not created by the teacher), an optional practice worksheet (not created by the teacher), and a handout with a list of websites for independent practice (created by the teacher). They also included slight changes to instructional procedures such as allowing students to work with partners or individually, allowing students to choose which worksheet to complete, and allowing students to decide what type of visual aide to include with a presentation.

While Teacher A did agree to participate in this study and was informed of the additional time that would be required, a minimal amount of additional time was invested, and thus robust UDL lessons were not implemented consistently. When asked whether she incorporated UDL principles into lessons the following school year, Teacher A reported that she does, and that designing lessons with UDL principles in mind is a good for all students, both those who struggle and those who are advanced. Training and experience with UDL through the present study may have contributed to Teacher A further exploring the UDL framework during the summer, which may have lead to implementation of some UDL principles during the following school year.

Teachers struggle to find time for required tasks throughout the work day (lesson planning, grading, parent contact) and often work beyond their required hours in order to get

everything finished for one day and prepared for the next day (Bruno & Ashby, 2012; Phillip & Kunter, 2013), so it is no wonder that teachers are protective of their time and selective of how they choose to spend it. Asking a teacher to learn a new skill and implement it immediately during the school year may be too much, especially when it is a new skill that requires a significant change in paradigms as UDL does for some teachers. Training teachers at the end of a school year so they can begin to dabble in it a bit and then additional training over the summer when teachers have more time (J. Greene, 2013; Sauer, 2011) may be a preferred method of professional development for UDL.

Teacher B

The mean UDL scores for Teacher B were 19% during the baseline phase, 69% during the treatment phase, and 88% during a third, researcher-designed lesson plan phase (see Figure 4) that was added because, despite continuous coaching, the teacher's lessons did not consistently incorporate UDL principles. During baseline, Teacher B implemented four lessons related to a unit on fractions. Lessons included adding and subtracting fractions with like and unlike denominators, and solving addition and subtraction equations that included fractions. During the treatment phase, Teacher B implemented nine lessons related to integers. Lessons included number lines and placement of integers, absolute value, adding, subtracting, multiplying, and dividing integers, equations with integers, graphing integers, and solving inequalities with integers. During the researcher-designed lesson plan phase, Teacher B implemented two lessons related to two-step equations and graphing inequalities.

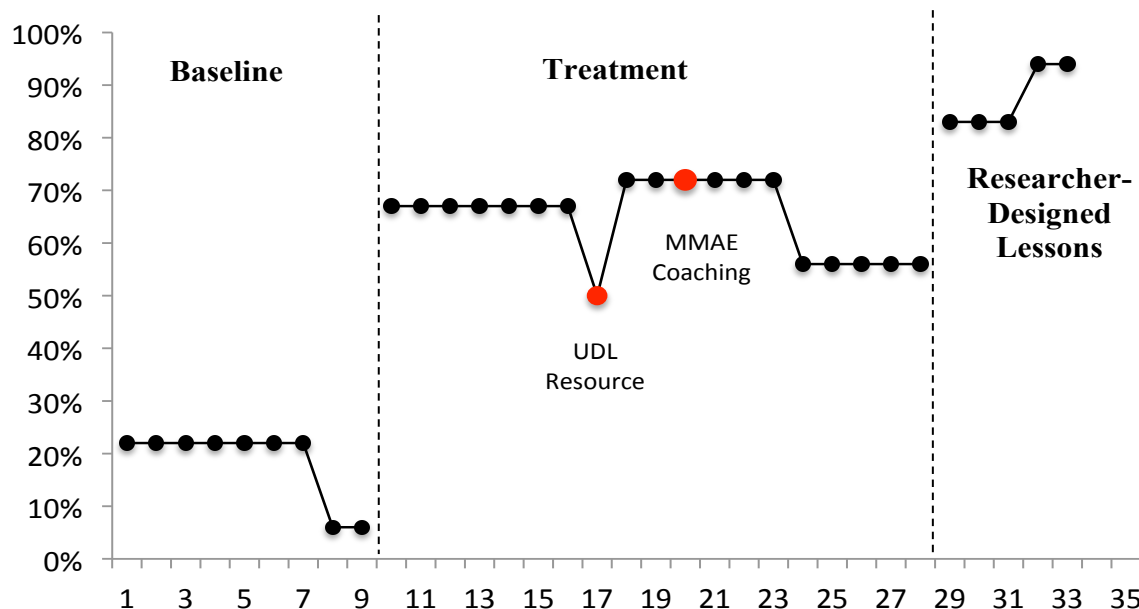


Figure 4. UDL Implementation Fidelity Scores for Teacher B.

During baseline, Teacher B's UDL principle element scores (see Figure 5) ranged from .0 to 1.00 on the 2.0 scale, which indicates that during baseline Teacher B did not design and implement lessons that were aligned with UDL principles. Baseline lessons were related to fractions, and were taken directly from the textbook in sequence. Each lesson spanned two or three days. For each lesson, all students were to attend to lecture and demonstration, do practice problems at their seats, and complete a worksheet for homework each evening. Representation of new material was provided in print and lecture format along with teacher demonstration on the white board at the front of the room (R1). Comprehension supports (R3) were provided in the form of chunking information into smaller parts, frequent review of concepts previously learned, and teaching strategies for following steps in a mathematical process, but understanding supports were not provided (R2). Understanding supports might have included pre-teaching academic vocabulary, or reviewing mathematical symbols relevant to the lesson. All students completed the same learning activity for each lesson: solving practice-problems on individual white boards at their seats. All students were given worksheets for homework, and students began worksheets

in class while the teacher walked around the room and provided individual instruction as needed. On day two of each lesson, students exchanged and graded homework papers, and then were given an opportunity to ask questions about problems they missed. Following peer grading, another homework assignment was given (worksheet) or a new concept was presented.

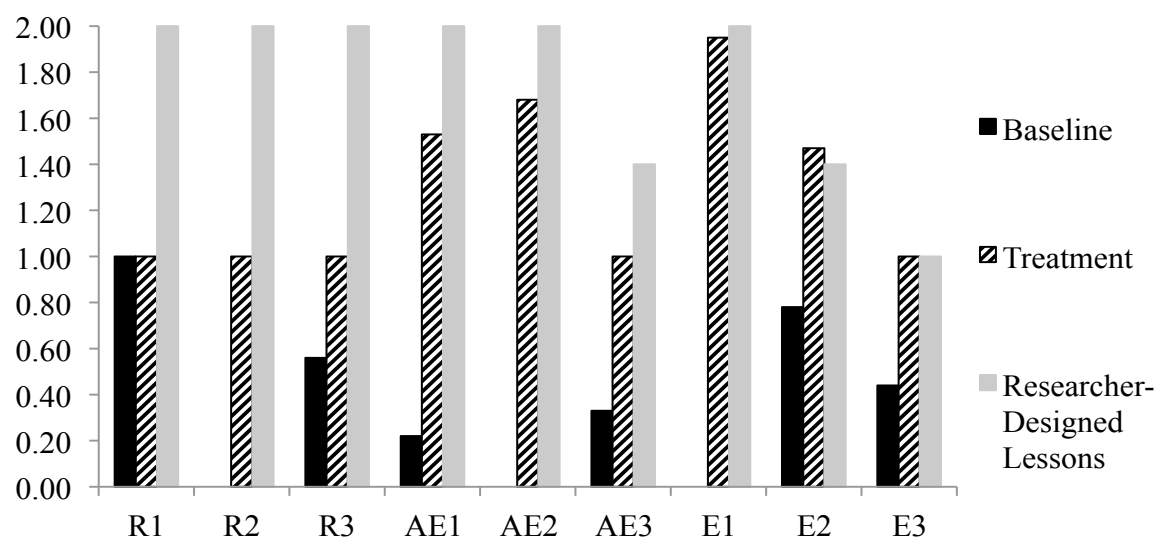


Figure 5. UDL Principle Elements for Teacher B

Lessons implemented during baseline would not be considered UDL lessons, because information was represented only in lecture, print, and demonstration formats (R1). Understanding supports were not provided (R2; e.g., vocabulary and symbols demystified), and comprehension was minimally supported (R3; e.g., patterns and big ideas highlighted). Students were not provided with options for learning activities (AE1) or assessments (AE2), and executive functioning (AE3) was supported only through general prompts (e.g., “Put your white board away and start on your homework.”). Students’ interest and effort were not supported (E1 and E2), and self-regulation supports (E3) were not provided beyond general classroom management for most students.

Behavior management was an obvious problem in this classroom. Target Student B2 was continuously out of his seat, talking, antagonizing other students by pretending he was going to

kick or hit them, or knocking papers or water bottles off of their desks. Lessons were continuously disrupted because Target Student B2 was talking loudly to the teacher or other students while the teacher was teaching. The current plan for dealing with this disruption was for the teacher and other students to ignore the inappropriate behaviors, but the plan was ineffective.

During the treatment phase, Teacher B improved over baseline in most areas of UDL (see Figure 5). The UDL principle element scores in this phase ranged from 1.00 to 1.95, which indicates that during the treatment phase Teacher B designed and implemented some parts of lessons with improved fidelity. During the treatment phase, Teacher B continued to implement lessons using the same routine as used in baseline (i.e., present new concept with demonstration, student practice at seats, worksheet for homework, peer grading, review of missed problems, present new concept). In order to modify lessons to be UDL lessons, Teacher B added some of the ideas discussed in training. For example, she implemented additional methods of representing information (R1; e.g., interactive demonstrations), but none of the additional methods was customizable by students (i.e., all students did the same activities in the same way).

Teacher B added support for understanding (R2) by implementing an activity where students created a flip chart for each new chapter of the textbook. In the flip charts, students wrote vocabulary words and definitions, and a sample problem for each section of the chapter. Orkwis and McLane (1998) noted that what may be a support to one student may be a barrier to another student. This is why a central premise of UDL is to allow students to have choices for how a learning experience or activity is approached or accomplished. In the case of Teacher B's class, one student may have found the flip chart helpful, but another student may have found it

more confusing. Providing options allows students to choose the learning experience that works best for them.

Teacher B adjusted the typical activity of guided practice with individual whiteboards to allow students to choose any tools they wanted when doing the practice portion of the lesson (AE1 and E1). This meant that students could do practice problems on an individual white board, on an individual chalkboard, or on paper. They could also choose to sit with a partner or a small group while doing the practice problems. In order to address multiple means of expression (i.e., assessment), on day two of the lesson (after peer grading) students were allowed to choose any way they wanted to demonstrate mastery of the skill (AE2). Students could work individually or with a partner or small group to be sure they understood how to solve the type of math problem currently being studied, then they had to go to the teacher and show her in any way they wanted (e.g., do a problem on the board, do a problem on paper) that they understood the concept. While these opportunities for choice met the UDL criteria for allowing choice on the surface, the choices did not add anything meaningful to the learning experiences or learning activities. Allowing learners to interact with the material/information in multiple ways means that learners can approach a task or attempt to learn the new information in a way that meshes with their personal strengths, interests, and preferences (Michael & Trezek, 2006). The choice between solving a sample problem on paper or individual whiteboard is of little consequence.

Learning activities beyond basic guided practice were not planned during baseline or treatment phases of the study despite coaching sessions in which the teacher was encouraged and offered help to plan them. Students continued to be assigned worksheets for homework, and despite the attempt at UDL assessment (mentioned above), students were still given paper/pencil tests as prescribed by the textbook. During coaching sessions, Teacher B talked about options

for learning activities and assessments, but then did not design and implement them. UDL resource materials were provided following several non-UDL lessons in the treatment phase, but UDL implementation did not improve (see Figure 4), and the teacher reported that she did not have a chance to look at the UDL Resource Packet. Teacher B received general coaching on UDL and specifically on multiple means of action and expression in order to encourage her to plan learning activities that would provide options for students, but, even so, lessons did not include UDL principles consistently following the coaching sessions (see Figure 4).

At this school, teachers of one grade level share responsibility for planning lessons. For example, one teacher plans 5th grade science and gives copies of the lesson plans to the other 5th grade teachers. Another teacher plans math and gives copies to the other teachers. During one coaching session, Teacher B commented that she wished more teachers were involved in the study because then she would have had others to talk to about it. She reported that it was difficult to do in isolation. As a result, lesson plans consisted of chapter and section numbers and no learning activities that would provide the students with options.

During the researcher-designed UDL lesson plan phase, Teacher B's UDL principle element scores ranged from 1.00 to 2.00. Teacher B implemented lessons designed by the researcher (see Appendix N), but not as they were intended to be implemented. A handout was provided with websites that the students could access for understanding and comprehension support (R1, R2, and R3) as well as additional practice (AE1) and to sustain interest (E1). The teacher was supposed to demonstrate how to access and use the websites, and get a set of laptops so some students could access the websites during class, but this was not done. Instead, the teacher gave the students the handout and told them that they could look up the websites if they

wanted to. There were video clips included in the lesson plans that explained the concept, but the teacher did not show them.

Additional learning activities were planned that utilized manipulatives. The lesson plan indicated that the teacher was to demonstrate how to use the manipulatives and then to allow students to work in pairs or individually on one of three options: practice problems from their book at their seats with paper or white board; practice problems from the book with manipulatives; practice problems with a computer game using laptop computers (<http://www.math-play.com/Two-Step-Equations-Game.html>). The teacher demonstrated how to use the manipulatives, and then commented that students could use the manipulatives to practice, or they could practice “the good old-fashioned way” on paper or white boards. The teacher did not provide laptop computers for students to choose the game option. By expressing a preference for the “old-fashioned” learning activity of practicing the problems in print rather than manipulatives, the teacher may have discouraged some students from choosing a method of interacting with the material that would have meshed with their strengths. Teacher B’s UDL scores improved during the third phase of the study because certain criteria were met, although not always in a meaningful way. Providing a list of websites for students to take home, for instance, is obviously quite different from showing students how to access the websites and allowing them to access the websites in class.

Teacher B made more of a consistent effort during the treatment phase to help students manage their behavior, but like Teacher A, this was accomplished mainly through general classroom management strategies. Despite suggestions during morning coaching sessions to frequently review classroom rules and expectations, to provide advanced preparation for transition to the next activity, or to implement a self-monitoring plan to help target students to

remain seated during instruction (Barbetta, Leong, & Bicard, 2005; Mundschenk et al., 2011), no customizable supports for self-regulation (E3) or executive functioning (AE3) were provided. Instead, Teacher B implemented an ineffective behavior management plan for Target Student B2, which resulted in the daily derailment of the lesson until the student was sent to the principal's office. This made for fragmented instruction for the other students and certainly reduced the teacher's level of energy to plan upcoming lessons. It most likely also had the effect of limiting the types of lessons and instruction that she felt comfortable trying for fear of making the situation in the classroom even worse.

Teacher B's ability to effectively design and implement UDL lessons seemed to be negatively impacted by her discomfort with departing from existing routines in this short period of time (10-week study). Some teachers are more hesitant than others to make significant changes in their teaching style. Broaddus and Bloodgood (1999) found that when implementing a reading intervention, it took a full school year for teachers to feel comfortable with the new intervention and take ownership of it. Teachers become more comfortable with changes when they see positive results in student outcomes (Guskey, 1986), but not all interventions are going to yield immediate results. Because UDL is a significant change for some teachers (somewhat of a paradigm shift), they may be leery of implementing the intervention fully, and may not implement it with fidelity. When interventions are not implemented with fidelity, they are less likely to result in improved outcomes (O'Donnell, 2008), which will, in turn, result in greater resistance and lower implementation fidelity.

Teacher C

The mean UDL scores for Teacher C were 16% during the baseline phase, 49% during the treatment phase, and 83% during a third, researcher-designed lesson plan phase (see Figure

6) that was added because despite continuous coaching, the teacher's lessons did not consistently incorporate the three principles of UDL. During baseline, Teacher C implemented six lessons related to a unit on plate tectonics, and a unit on galaxies. These units included lessons on convergent and divergent plates, volcanoes and earthquakes, and types of galaxies. During the treatment phase, Teacher C implemented five additional lessons related to the unit on galaxies. This unit included lessons on stars, space exploration, comets, and meteors. During the final phase, Teacher C implemented lessons designed by the researcher, which were related to a unit on weather. This unit included lessons on atmospheric layers, and weather forecasting.

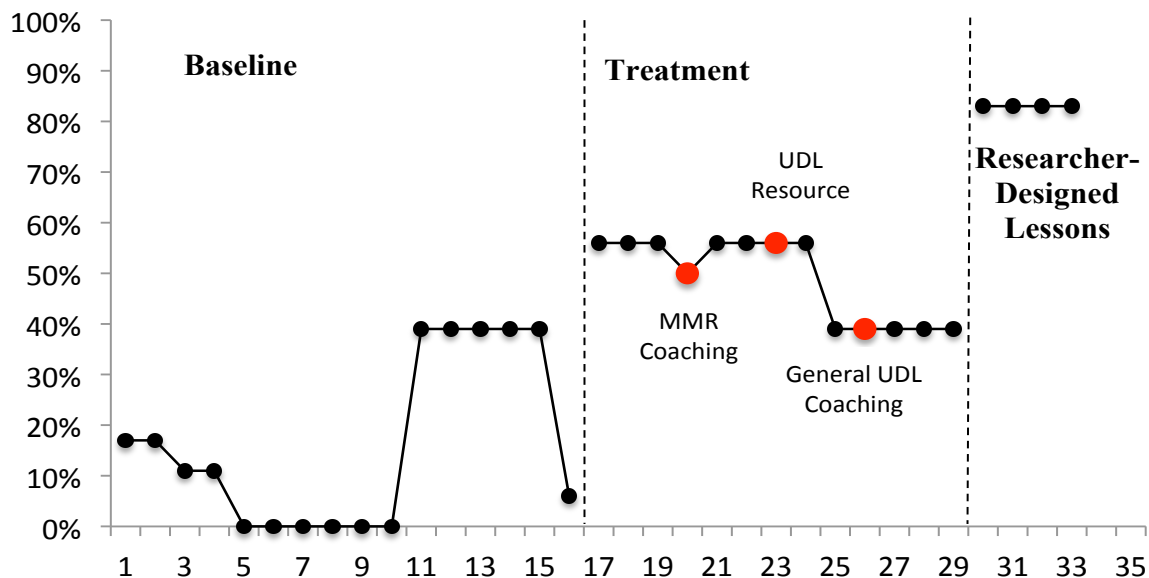


Figure 6. UDL Implementation Fidelity Scores for Teacher C

During baseline, Teacher C's UDL principle element scores (see Figure 7) ranged from .0 to .63, which indicates that Teacher C did not design and implement lessons that were aligned very well with UDL principles. Each lesson that Teacher C implemented included students reading aloud from the textbook when called upon by the teacher (R1), the teacher clarifying and summarizing what was read (R3), students completing worksheets in class and/or for homework and then trading papers and grading homework the next day. Occasionally, the teacher's

assistant would look for a related video on the Internet while students were reading, and if a video was found it would be played during or at the end of the lesson. At the end of three or four lessons, there were several days of test review (R3; re-reading from the textbook, completing related worksheets, discussions, reviews) followed by a paper and pencil test (AE2).

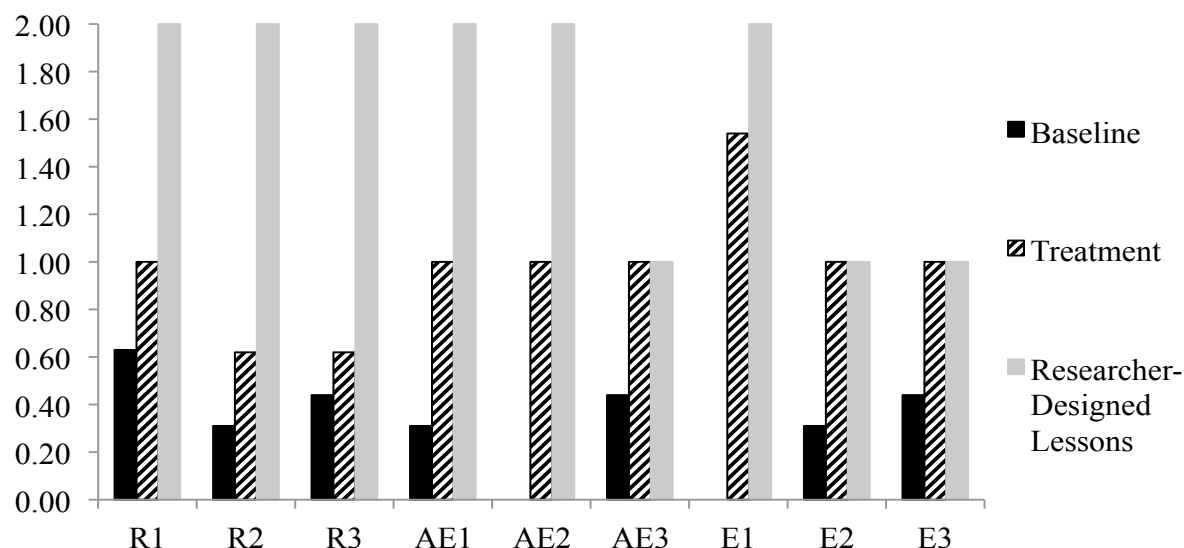


Figure 7. UDL Principle Elements for Teacher C

Lessons implemented during baseline were not considered to be UDL lessons because information was rarely represented in ways other than print and lecture (R1), supports were not provided for understanding (R2), and students were not provided with options for learning activities or assessments (AE1 and AE2). Executive functioning skills (AE3) were not supported beyond general classroom management prompts, and self-regulation skills (E3) were supported via a whole class behavior management plan where students moved a clothespin from one portion of a poster board to another which indicated loss of privileges. Individual students were directed to move their pins when the teacher became exasperated with their behavior. None of the supports that were provided were customizable, which is what is required for a lesson to be considered a comprehensive UDL lesson.

During the treatment phase, Teacher C improved over baseline in all areas of UDL (see Figure 7) with UDL principle element scores ranging from .62 to 1.54, which indicates that Teacher C designed and implemented some parts of lessons that were moving toward UDL principles. During the treatment phase, Teacher C continued to implement lessons using the same routine as was used in baseline (i.e., students read aloud from textbook, teacher clarified and summarized, students completed worksheets for in-class work and/or homework, students graded peer's papers, students read aloud from text). In order to modify lessons to be UDL lessons, Teacher C added some of the ideas discussed in training. The teacher made a greater attempt to connect the topic to learners' existing interests (E1) via discussion, and added more opportunities for students to have choices (AE1). For example, when a worksheet was assigned on galaxies, students were allowed to work with a partner or small group (AE1) and choose which type of galaxy (e.g., elliptical, spiral, irregular) they wanted to read about (AE1, E1). Although the choice of working with partners and the choice of worksheets did provide students with options, the options were not aligned to their strengths, interests, and preferences. The teacher used the worksheets to assess student understanding (AE2), but textbook tests were still administered at the end of each chapter. Executive functioning skills (AE3) and self-regulation skills (E3) were minimally supported via general classroom management and behavioral prompts (e.g., "You have five more minutes with your partner.").

During morning coaching sessions, Teacher C was frequently unsure of her plans for the day, and lesson plans were rarely turned in to the researcher. Despite coaching sessions that focused on multiple means of representation (see Figure 6), Teacher C continued to represent information using the textbook, student reading, and discussion. The UDL Resource Packet was provided (see Appendix M), but UDL scores were not affected (see Figure 6). One coaching

session focused on general UDL principles because the teacher reported having difficulty filling out the UDL-FT. UDL scores did not increase after this coaching session either (see Figure 6). After increased coaching proved to be ineffective, the researcher provided an exemplar UDL lesson plan (see Appendix O) for Teacher C to implement.

During the researcher-designed UDL lesson plan phase, Teacher C implemented a lesson designed by the researcher, and her UDL principle element scores ranged from 1.00 to 2.00 (see Figure 7). The exemplar UDL lesson incorporated all UDL elements, and if implemented with fidelity would have resulted in a comprehensive UDL lesson. A handout was provided with interactive websites that the students could access for understanding and comprehensions support (R1, R2, and R3) as well as to gain additional information if desired (AE1), and to sustain interest (E1). The lesson plan directed the teacher to demonstrate how to access and use the websites, but the teacher only gave the students the handout and showed one video clip from one of the websites rather than showing them how to access and use the websites on their own.

Although providing the handout met the UDL-FT criteria for supporting understanding and comprehension in a customizable way, it was ineffective since students were not shown how to use the sites. According to the lesson plan, students were to read two or three articles on the atmosphere and weather from the Internet. Students could choose to read the article alone or with a partner (AE1), and in print format or digital format (R1, R2, R3), but while the teacher did allow them to read with a partner, computers were not provided for the students to access the articles in digital format, which would have added customizability.

The primary learning activity for the researcher-designed lesson plan was a project. Students demonstrated understanding of the basic concepts of atmosphere and weather by creating a children's book, a poster, a song or rap with an album cover, or a poem with an

illustration. Examples and a rubric were provided to help students to understand what would be required in the final product (R2, AE3, E1). The lesson was fragmented over several days due to end of the school year activities (e.g., field day, field trip), which impacted the robustness with which it was implemented.

Teacher C did make more of an effort during the treatment phase to help students manage their behavior, but like Teachers A and Teacher B, it was mainly through general classroom management strategies. Despite suggestions during coaching sessions to implement a self-monitoring program (Zimmerman, 1998) with both target students in order to improve attention, no supports for self-regulation (E3) or executive functioning (AE3) were provided.

Teacher C's ability to design and implement effective UDL lessons seemed to be negatively impacted by lack of pedagogical skills and self-efficacy. The teacher elected to use round-robin reading, worksheets, and tests as learning activities rather than more creative learning activities even though alternate lesson plans (which included project-based learning activities) were provided by another teacher because teachers shared responsibility for writing lesson plans at school A. Because a teacher's edition of the science textbook was not available, Teacher B used the text as a resource that supplemented trade books such as *Universe* from the DK Eyewitness Books series, the teacher's chief source of material for class lessons. Throughout the study, Teacher C seemed to be under stress, which impacted her ability to fully focus on, understand, and implement UDL lessons. It also seemed to make a less controlled classroom environment intolerable for her, which would also impact her comfort level with UDL lessons.

Kunter et al. (2013) assert that teacher efficacy encompasses pedagogical content knowledge (knowing the subject matter and how to make it accessible to students), beliefs

(transmission versus constructivist), motivational orientation (intrinsic versus extrinsic), and self-regulation skills (ability to cope with stress). When one of these areas is insufficient, it is likely to impact instruction. Edyburn (2010) questions whether teachers can function effectively as instructional designers in addition to all the other demands placed on them. Teacher C is an affirmative illustration of this point. Design and implementation of the UDL lessons were beyond the teacher's current ability; however, when the lesson was designed for her, Teacher C was able to implement it to a certain extent. Given additional time and more opportunities to practice, the teacher may have become quite competent in the implementation of UDL lessons.

Teacher D

The mean UDL scores for Teacher D were 06% during the baseline phase and 64% during the treatment phase (see Figure 8). During baseline, Teacher D implemented nine lessons related to a unit on a novel, which included reading, journaling, and assessments (i.e., quizzes). During the treatment phase, Teacher D implemented five lessons related to a unit on storytelling (legends, folktales, and tall tales), which included reading, watching videos, and engaging in interactive reading along with non-UDL assessments as in baseline.

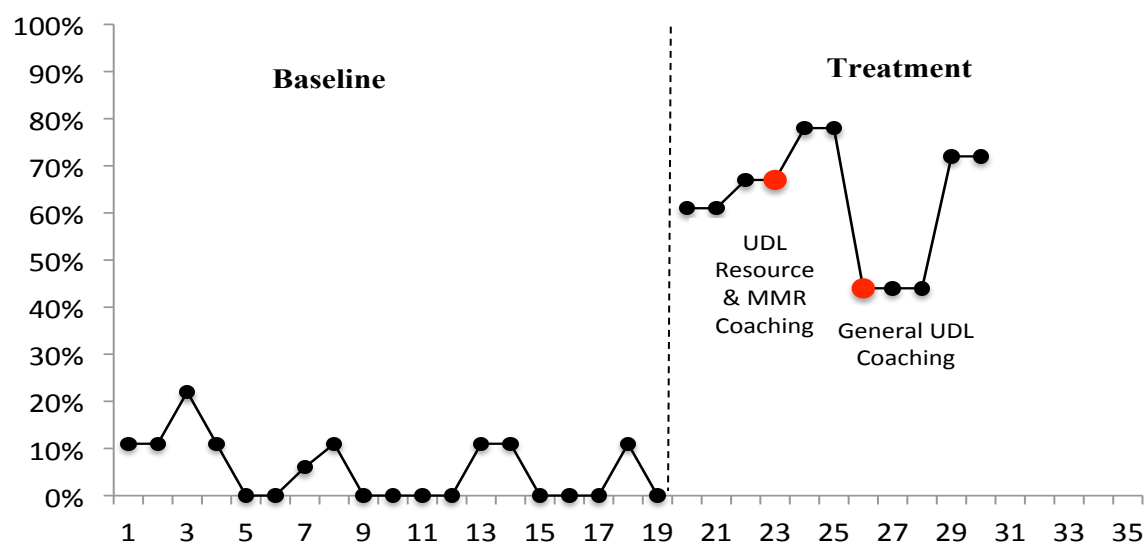


Figure 8. UDL Implementation Fidelity Scores for Teacher D

During baseline, Teacher D's UDL principle element scores (see Figure 9) ranged from .0 to .32, which indicates that during baseline Teacher D did not design and implement lessons that were very well aligned with UDL principles. Aside from lessons 8, 13, and 18, which consisted of a web-based reading program called Teen Biz 3000, all baseline lessons were related to a novel. On the days that were scheduled for Teen Biz, students accessed the program independently, and no instruction was provided other than general directions (e.g., when to get computers, what to do when finished). The program itself included some UDL principles such as built-in vocabulary support, but it was not a teacher-designed lesson. Lessons related to the novel typically began with a review of the story (R3) and a brief lecture (R1) about a literary term (e.g., foreshadowing) followed by the teacher and/or students reading aloud, and then students reading silently (R1). Information was primarily represented via oral and print methods, but on one occasion a map was used to explain where characters in the story were rafting, and on another occasion a guest speaker presented on the topic of mountain climbing and rappelling (R1, R3, E1). Students were responsible for reading a small portion of the novel each day (R1), and learning activities involved journaling about specific aspects of the novel (R3, E1). The teacher assessed student understanding via discussion, quizzes, and a summative assessment. (AE2).

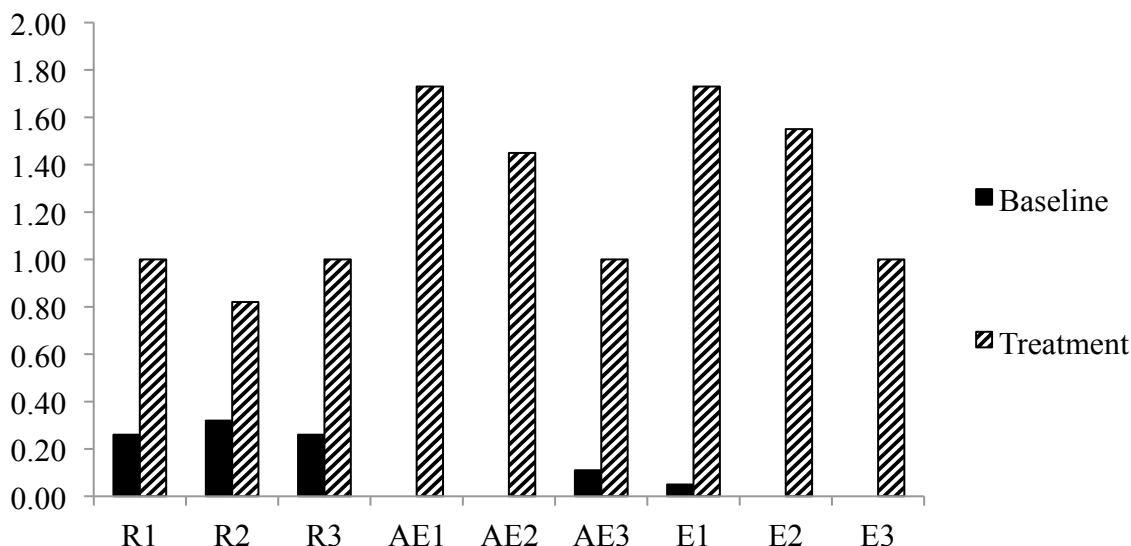


Figure 9. UDL Principle Elements for Teacher D

These lessons would not be considered UDL lessons because information was rarely represented in ways other than print, oral reading, lecture, and discussion (R1). Supports were rarely provided for understanding and comprehension (R2, R3), and all students completed the same learning experiences and activities in the same way (AE1, AE2). Additionally, student interest and effort were not supported (E1, E2), and executive functioning skills (AE3) and self-regulation skills (E3) were not addressed with the target student or any other students.

During the treatment phase, Teacher D improved significantly over baseline in all areas of UDL (see Figure 9) with UDL principle element scores ranging from .82 to 1.73, which indicates that the teacher designed and implemented parts of lessons that were approaching a comprehensive level of UDL. Only one lesson, however, was considered a comprehensive level of UDL (see Figure 8). During the treatment phase, Teacher D primarily represented material in print and oral format, but occasionally added an additional format (R1; e.g., maps, video clips). The teacher supported understanding and comprehension by drawing students' attention to various elements in the textbook (e.g., lists of vocabulary words for the unit), and helping

students to activate their existing knowledge on the topic via class discussion (R2, R3). Teacher D provided students with options for learning activities (AE1) by allowing students to choose alternative activities in place of certain pages in packets of worksheets, and by allowing them to choose to work individually or with partners (AE1). For one learning activity, students chose to read the story on their own, with a partner, or via audio recording (R1, R2, and R3). Students were also provided with options for learning activities (AE1). They were to identify one or more parts of the story that represented an exaggeration (e.g., Paul Bunyan ate 50 pancakes in one minute). They could write about the exaggeration or draw or download and print a picture to depict what was exaggerated. The learning activity was assessed to determine student understanding (AE2) so no formal assessment was administered.

For a different lesson, students chose to write definitions of vocabulary words, draw representations of vocabulary words, or get pictures from the Internet to depict vocabulary words. These learning activities allowed students to select methods of engaging with the material that maximized their strengths and minimized their weaknesses – a customizable support that also might spark sustained interest and effort (E1, E2). Teacher D's UDL scores improved after coaching on the multiple means of representation (see Figure 8), and she commented that she realized she had been doing her students a “disservice” by always presenting information in lecture and print. However, UDL scores dropped for the next lesson, which consisted of a full video (cartoon representations of tall tales and legends from the past few lessons) spread over three days. The learning activity was for students to take notes on notebook paper or on a graphic organizer worksheet on characters from the video. Following that lesson, there were several days where no lessons were planned due to end of the year activities (e.g., semester exams, field day). The last lesson consisted of students reading an adventure story (of

their choice) from *Scope Scholastic Magazine*, and writing a review. They could work with partners or individually and could use paper or computer to write their review.

Teacher D made more of an effort during the treatment phase to provide supports for executive functioning (AE3) and self-regulation (E3), but, like teachers A, B, and C, efforts did not venture beyond general classroom management strategies. Target Student D1 was frequently off task and careful to plan behaviors (e.g., making faces at peers, knocking papers from a peer's desk) for when the teacher was not looking. Despite discussions during coaching sessions to help Target Student D1 set a personal behavioral goal and devise a plan to self-monitor progress, the teacher only occasionally redirected the student's off-task behavior.

Teacher D conveyed, in conversations with the researcher, a deep understanding of UDL and expressed on several occasions a belief that the UDL framework was good for all students. When the teacher did design and implement UDL lesson components, she mentioned to the researcher during morning coaching sessions how pleased she was with the results (i.e., the target student and others seemed more interested and actively involved in the learning activities). Despite this positive attitude about UDL, Teacher D invested very little additional time on lesson plans during the treatment phase of the study, and thus designed and implemented only one lesson that was approaching a comprehensive level of UDL.

Teacher E

The mean UDL score for Teacher E was 39% during the baseline phase and 93% during the treatment phase (see Figure 10). During baseline, Teacher E implemented nine lessons related to units on weather and erosion, and rocks and minerals. Lessons included projects and learning activities related to the earth's crust, mountains, volcanoes, earthquakes, and continental drift. During the treatment phase, Teacher E implemented six lessons related to units on the rock

cycle (overlapping with the rocks and minerals unit), meteorology, and summer safety. Lessons included projects and learning activities related to rock classification, and severe weather.

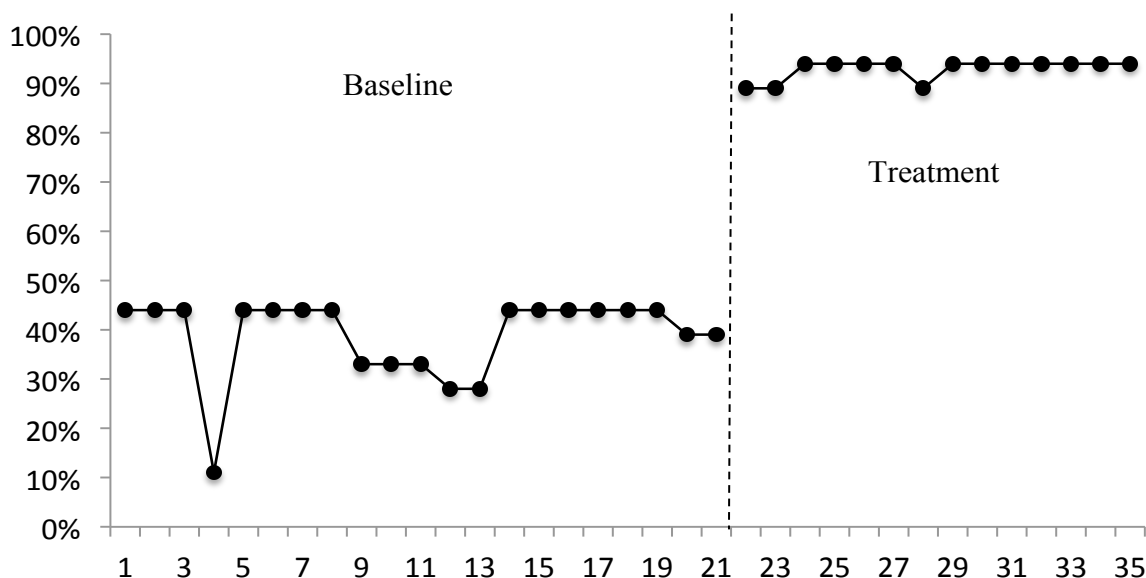


Figure 10. UDL Implementation Fidelity Scores for Teacher E

During baseline, Teacher E's UDL principle element scores (see Figure 11) ranged from .0 to 1.33, which indicates that Teacher E designed and implemented some lesson parts that were aligned with UDL principles. Teacher E's baseline scores were significantly higher than the baseline scores of the other teachers (see Figure 1), which suggests she began the study with a teaching philosophy that was already aligned with UDL principles. This was also evident in Teacher E's classroom arrangement, as student desks were arranged in groups of five or six students facing each other rather than rows facing the teacher. During baseline, Teacher E frequently represented information in multiple ways (R1) including students reading aloud with a microphone, video clips, WebQuests (www.webquest.org), and digital images shown on the SMART Board. Supports for understanding and comprehension were provided via typical teaching strategies of pre-teaching vocabulary and helping students to access their existing

knowledge on various topics (R2, R3). Information was also presented in increments (R3) as students worked on projects. This had the effect of providing frequent review (R3) as new information was discussed and connections were made to the information presented previously.

Learning activities presented in baseline were largely project-oriented. Students often had choices of whether to work alone or with a partner (AE1), but the projects to be completed were the same for everyone. For example, in one lesson, all students created a flip chart with a picture and information about volcanoes, earthquakes, and mountains, and in another, they were all to design a course to teach others about rocks. Teacher E provided rubrics for projects so students could plan (AE3) their projects to meet specific criteria, which resulted in meeting the learning goal(s). The teacher used class discussion related to current news stories to spark interest in topics and encouraged students to share their thoughts (E1). During one lesson, a student shared a book from the public library with the class via the document camera (R1).

In order to sustain effort, students were provided with continuous prompts and feedback on their progress with the projects (E2). The teacher began each class with a recap of the topic and project overview, which often included additional information (R1). The teacher also frequently set a timer on the SMART Board to give students a specific amount of time to complete a task (AE3, E2). For example, after reading a section from the textbook, students had two minutes to share their thoughts on the topic with their groups.

Teacher E supported self-regulation skills (E3) through general classroom management strategies. When groups were on-task and behaving appropriately, they received a tally mark. Tally marks resulted in rewards and special privileges for groups (e.g., go to lunch first, come in from recess last). Students who continually disrupted their groups were removed from groups temporarily, and allowed to return after a specific period of time. Behavioral supports were not

provided beyond this classroom management system.

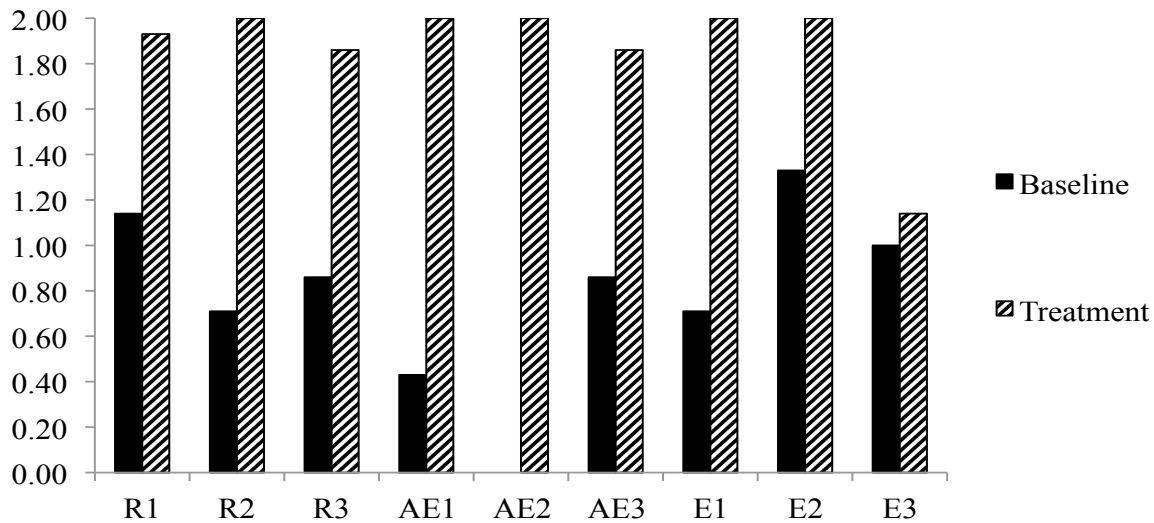


Figure 11. UDL Principle Element Scores for Teacher E

Despite the supports offered during baseline, these lessons would not be considered comprehensive UDL lessons because all students completed the same tasks in the same way (AE1, AE2), and no customizable supports were offered.

During the treatment phase, Teacher E improved over baseline in all areas of UDL (see Figure 11) with UDL principle element scores ranging from 1.14 to 2.0, which indicates that during the treatment phase, Teacher E designed and implemented comprehensive UDL lessons. During that phase, Teacher E continued to do all the same things she did during baseline, but added the element of student choice when possible by allowing students to choose from limited, well-planned options on almost every task. For example, after watching a video about tornados, students could choose from several options to show the teacher what they learned. The teacher asked the students to come up with the options, which resulted in several options that were acceptable to the teacher and students: write a paragraph, write five fun facts, compare the video to a recent handout, and draw a picture with a description. On more in-depth assignments (i.e., projects), students were allowed to choose from teacher-determined options (PowerPoint, book,

poster, essay). Students were also allowed to work individually or with a teacher-selected or student-selected partner. The teacher provided one rubric that worked for all project options because the rubric was simplified to address the learning goals, but not the specifics of the projects.

In order to make the supports for executive functioning and self-regulation customizable, Teacher E helped some students to set personal learning goals (AE3) and some students to set personal behavioral goals (E3). When they were removed from their groups for inappropriate behaviors, the teacher worked with them to identify what behaviors were needed in order to return to the group, and then helped them to monitor their behaviors in order to achieve their goals.

Teacher E seemed to more easily design and implement UDL lessons because she already had a teaching philosophy that was aligned with UDL principles. A change in teaching style requires a shift in teaching philosophies (Chapman & Heater, 2010), so it makes sense that when a teacher already has a teaching philosophy aligned with the new intervention, it would be easier for that teacher to incorporate the new intervention.

Teachers' Response to UDL Elements

Overall, teachers seemed to understand and embrace the concept of UDL. During training sessions all teachers agreed that the concept made sense, but also expressed concern over how they would satisfy all the elements discussed during the training. Figure 12 displays the mean UDL principle element scores for all teachers for the baseline and treatment phases (but not the researcher-designed lesson plan phase because only two teachers received that level of coaching support). Some UDL elements seemed to be easier, or already incorporated into their existing practices (e.g., accessing background knowledge, reviewing concepts), while other

elements seemed to be more difficult and outside teachers' comfort zones (e.g., allowing students to demonstrate mastery in different ways).

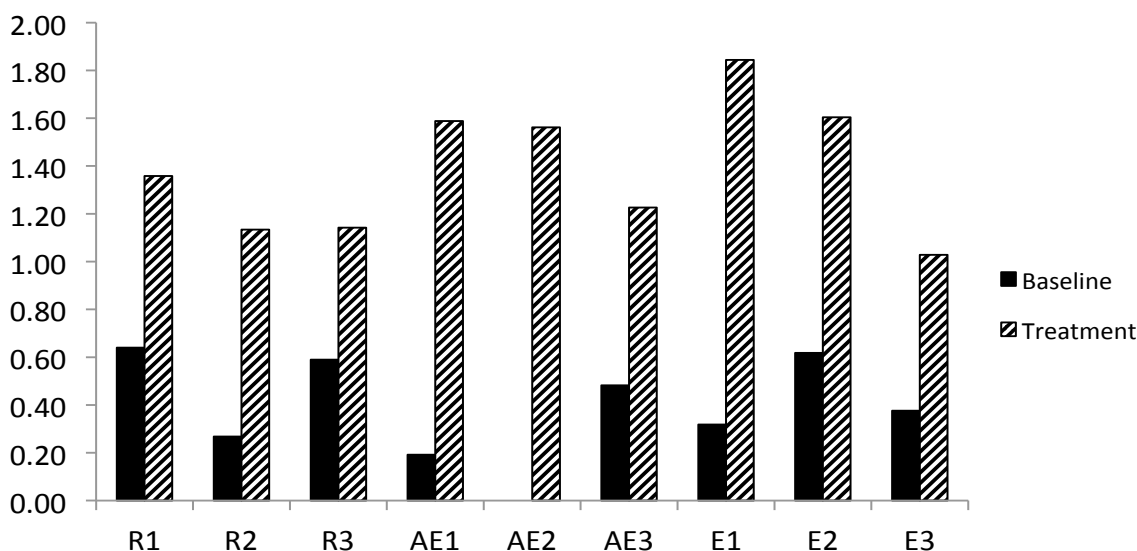


Figure 12. UDL Principle Elements for All Teachers

Multiple means of representation. The principle of multiple means of representation signifies that information is conveyed to students in a variety of ways with a variety of supports in order to increase the probability that all students will be able to properly perceive, understand, and comprehend the information (Rose & Meyer, 2009; Rose & Strangman, 2007). Teachers seemed to easily understand the concept of representing information in multiple ways so that students could properly perceive it, but only two teachers consistently did so throughout the treatment phase (Teachers A and E). On several occasions, teachers commented that they simply lacked time to look for ideas, let alone time to design or create additional methods to present the content.

Teachers seemed to struggle more with supporting understanding than comprehension. Supporting understanding relates to unlocking codes and making information plain and clear (e.g., explaining a graph or symbol rather than expecting the learner to already know it; CAST, 2012). This sometimes requires utilization of technological supports (e.g., embedded vocabulary

support, text-to-speech software), and although teachers expressed an interest in offering this type of support, the only one who attempted to do so was Teacher E who used a WebQuest with links to vocabulary-embedded websites as a learning activity.

Teachers appeared to more easily address comprehension supports. Supporting comprehension involves instructional strategies such as activating background knowledge, chunking information, and highlighting patterns and big ideas. These supports were present during the baseline phase for all teachers, which indicates that these strategies were already part of the teachers' repertoires.

Comprehensive UDL could be achieved in the area of multiple means of representation by providing customizable supports and making those customizable supports available to students outside of class. This was an area of difficulty for Teachers A, B, C, and D. When they achieved this higher level of UDL, it was mainly through low-tech methods: providing a list of websites for students to look up on their own, providing a handout with answers for students to assess their own understanding prior to a quiz. Teacher E accomplished this comprehensive level of UDL easily through a class website. While all teachers had the ability through their schools to create a class website, Teacher E was the only one who had a functioning and regularly updated website. When supports are accessible to students outside of class, they can engage with them repeatedly and as often as needed. Clarebout, Holger, Schnotz, and Elen (2010) found that the quality of support usage increased when students were allowed to decide whether to utilize them. Making the customizable supports accessible to students requires making them aware of the supports and teaching them how to access and utilize the supports.

Multiple means of action and expression. The principle of multiple means of action and expression implies that students are allowed to interact with new information and express

their understanding of the new information in ways that are aligned with their strengths, interests, and preferences in order to maximize their strengths and minimize their weaknesses (Rose & Meyer, 2009; Rose & Strangman, 2007). Although teachers seemed to easily understand and embrace the idea of allowing students to have choices for learning activities, choices were rarely offered during baseline, and when they were, they had more to do with materials than learning activities (e.g., do practice problems on the board or at the seat). No teacher offered choices for assessments during baseline. When teachers did offer choices for learning activities (in baseline and treatment phases), the options were inspired by the teachers (with the exception of Teacher E on one occasion), and were not a result of careful consideration of student strengths, interests, and preferences.

During training sessions, teachers filled out a class learning profile, which is a CAST-developed tool to help teachers become more aware of students' strengths, interests, and preferences so they can consider them during lesson planning. CAST recommends filling out a class learning profile for each lesson plan in order to help the teacher think about students' strengths, interests, and preferences related to each individual lesson. During training sessions, teachers were encouraged to fill out the class learning profile for each new unit, but it was not a requirement of the study. No teachers filled out class learning profiles for subsequent lessons, however, and there was no evidence that teachers employed them during lesson plan design. Ignoring the class learning profile resulted in lesson plans that were not well aligned with learner strength, interests, and preferences. While it may be unrealistic to expect teachers to fill out a class learning profile for each lesson, filling one out for each unit or each subject area seems reasonable. Perhaps it was overlooked by teachers in the present study because they were not

spending time looking for new learning activities. If they were looking for new learning activities, it would seem natural that the class learning profile would guide this process.

Teachers seemed to struggle most with allowing students to demonstrate mastery and understanding in multiple ways (i.e., multiple means of expression). All teachers continued to administer paper/pencil assessments in addition to UDL assessments, which typically consisted of grading UDL learning activities. We are obsessed with testing in the United States (Davis & Swarts Gray, 2007), so it is no wonder that teachers feel pressured to adhere to the policy of paper/pencil assessments over more flexible assessment (Smith, 1991) such as projects that are graded with rubrics. UDL, however, calls for flexible assessments that allow students to demonstrate their understanding of the material they have learned in a variety of ways (Rose & Meyer, 2009). UDL assessments make it possible for students with disabilities to minimize their weaknesses and show what they have learned (Dolan, 2000; Johnstone, 2003).

All teachers supported executive functioning skills by use of general classroom management strategies, but only two teachers made this support customizable by working with students to set personal learning goals. Both did this by means of discussions related to project rubrics and making plans to reach specific goals. UDL calls for executive functioning support in the form of helping students to manage their time and workspace along with their attention. Johnson and Reid (2011) recommend explicit instruction on academic strategies related to planning and organizing. This can be done by setting a goal for the task and providing support for monitoring progress. The authors further note that this explicit executive functioning instruction will benefit all students.

Multiple means of engagement. The principle of multiple means of engagement signifies that student strengths, interests, and preferences are employed in order to spark interest,

sustain effort, and support behavior (Rose & Meyer, 2009; Rose & Strangman, 2007). Although teachers did not always address each of the three elements of this principle (i.e., supporting learner interest, supporting learner effort, and supporting learner self-regulation skills) in baseline, all were addressed during the treatment phase to some extent. Although practiced inconsistently during baseline, teachers knew to support engagement by emphasizing the relevance of the learning objective (support for interest) and emphasizing the importance of the learning objective and by providing feedback (support for effort). These methods of supporting engagement were somewhat generic, and only contributed to a non-robust UDL lesson. Comprehensive UDL, however, requires teachers to delve deeper into engagement supports by offering choices for how the learning goal is achieved, and providing feedback that is aligned with learner strengths, interests and preferences. When teachers did meet the criteria for comprehensive UDL in this area, it was by adjusting the degree of difficulty or level of support in order to promote individual success and increase the desire to put forth effort. For example, in one lesson, students were allowed to choose which worksheet to complete for homework based on their self-assessment of the level of difficulty that would challenge, but not frustrate them. In another assignment, students could choose to work with a partner in order to provide support for one another.

Self-regulation seemed to be the most difficult element for teachers to address, but it is an important element for students with behavior problems. During baseline, teachers A, C, and D generally left students to manage their own behavior assuming that typical classroom discipline measures (e.g., verbal warning, class dismissal) would be sufficient. Teacher E implemented class-wide behavior management strategies that were able to work at the level that individual students needed. Both target students experienced being moved away from their groups and

having to demonstrate specific self-regulation skills in order to rejoin groups. After UDL training, the teacher attempted to add personal behavioral goal-setting and self-monitoring of behavioral goals to the existing plan in order for it to be customizable for students. In addition to typical classroom discipline measures, Teacher B's classroom aide attempted to support students' self-regulation by providing individual attention or assistance with assignments when students were disruptive. Target student B2, however, had a behavior management plan that was ineffective despite significant effort on the part of the teacher.

Schunk and Zimmerman (1998) pointed out that teachers typically do not know how to teach self-regulation skills, and when they have the inclination to try to do so, they are often discouraged because of other demands placed on them. In order to implement UDL with fidelity in this area, teachers needed to explicitly teach self-regulation skills and provide customizable support for self-regulation. Despite coaching that addressed self-regulation, teacher participants generally avoided this element, which means that more professional development may be needed in this area in order for UDL to be implemented with fidelity.

UDL Lesson Planning

Spooner et al. (2007) found that pre-service and in-service teachers could write lesson plans that incorporated UDL principles after a simple one-hour training session on UDL. In the present study, teachers were not required to comply with a particular lesson plan format because it was suspected that such a requirement would deter teachers from participating in the study. Although teachers did implement lessons with some UDL principles, they did not indicate the UDL principles on their lesson plans. In fact, teacher participants composed very sparse lesson plans throughout the study despite the fact that part of the training session focused on lesson planning.

During baseline, four teacher participants (A, B, C, and D) used a standard lesson plan book formatted with boxes to indicate plans for each period of the day over a course of one week. Teacher E typed her lesson plans on the computer. Lesson plans for teachers A, B, C, and D generally included only a brief note or two for each day. For example, Teacher A indicated “DOL #10” and “computer research” for one lesson during the baseline phase. Teacher B indicated chapter and section number (e.g., “5-2”) for all lessons during the baseline and treatment phases. Teacher C sometimes did not have lesson plans for the day and filled out her plan book after the day was over indicating what was done during the day. Teacher E indicated lesson activities in complete sentences, and also included assessment methods when assessments were planned. None of the teachers indicated lesson goals, objectives, or formative assessments, and learning activities were indicated in only some of the plans sporadically.

During training, all teachers were provided with UDL Lesson Plan Guidelines (see Appendix K), which employs the backwards design framework (McTighe & Wiggins, 1999), and prompts teachers to identify desired results (goals), determine acceptable evidence of understanding (assessments), and then plan learning activities that incorporate the principles of UDL to help students achieve the goals. None of the teachers indicated having previous experience with this lesson plan format, but all indicated that they liked the format and understood its benefits. Despite their response to the backward design lesson plan format during training, all teachers continued to utilize their previous lesson plan format throughout the entire study.

Student Engagement

Research question #2: When compared with non-UDL treatment conditions, does the implementation of UDL in secondary general education, inclusive classrooms result in increased

academic engagement for students with EBD and/or students who are at-risk for academic failure due to behavior problems?

Data on student engagement were collected throughout all phases of the study with the Behavioral Observation of Students in Schools (BOSS; Shapiro, 2011a). As described in Chapter Three, the tool was modified slightly to exclude specific categories of off-task behavior (i.e., off-task motor, off-task verbal, off-task passive), as these were not germane to this investigation. Data were collected on student active engaged time (AET), passive engaged time (PET), off-task time (OT), and also on teacher directed instruction (TDI).

A secondary data collector served as a reliability check on 34% of the recordings. Coefficients of reliability on individual codes were calculated by dividing the number of agreements by the number of agreements plus the number of disagreements multiplied by 100 (Kazdin, 2003). The mean inter-observer agreement coefficient was 99.75% for all codes, thus the overall inter-observer agreement was 99%. Recorded observations made it possible to achieve this high level of agreement.

A visual analysis of the relationship between target students' active engaged time (AET) scores and teacher participant UDL implementation fidelity scores reveals that AET did not vary with UDL implementation (see Figure 13). However, a closer examination of individual data points in conjunction with video recorded observations and anecdotal notes reveals specific patterns related to UDL approaches and corresponding increases in AET.

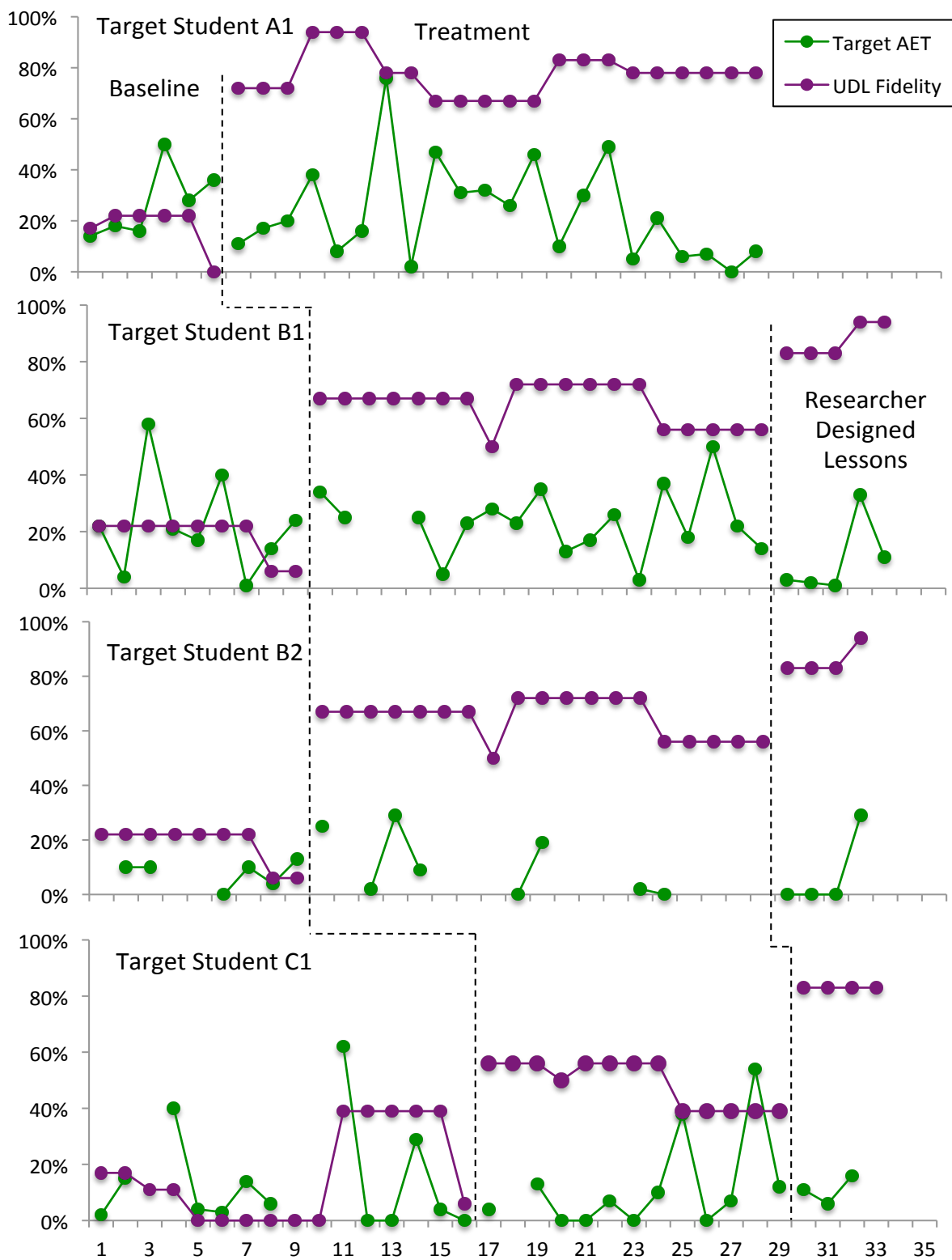


Figure 13. Student AET and Teacher UDL Implementation

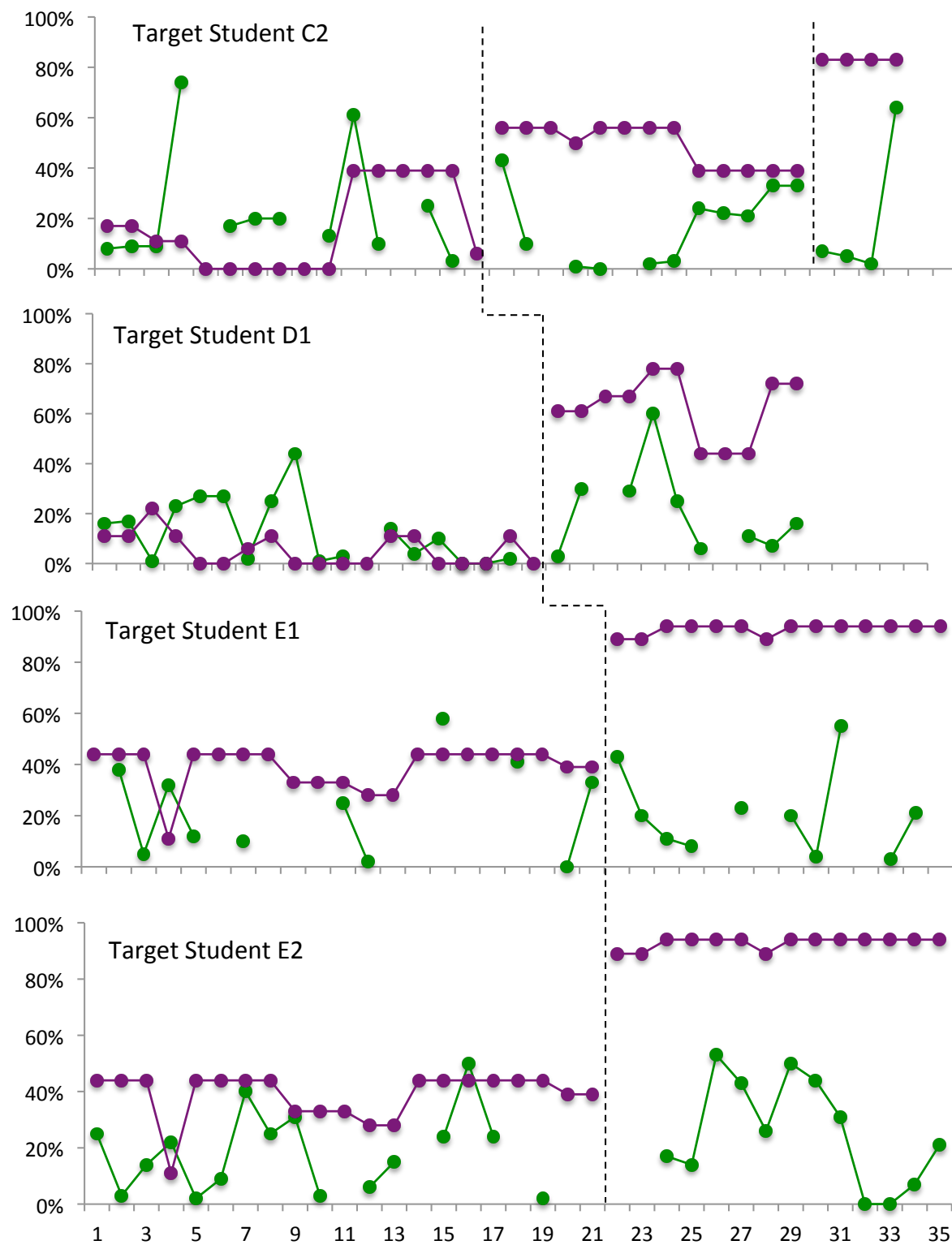


Figure 13. Student AET and Teacher UDL Implementation

In the following section, each target student's highest and lowest AET scores are reported along with a description of the types of activities in which students were engaged. The absence of further increases in these scores is discussed.

Target Student A1

A visual inspection of target student A1's AET scores indicates that the level of engagement did not improve with the increased level of UDL lesson plan implementation (see Figure 13). The student's highest AET scores occurred during sessions where in-class work was assigned and completed during class time (e.g., a test or worksheet; sessions 4 and 13; 50% and 75% AET). The student's lowest AET scores occurred during peer grading, lessons where only one student participated at a time (e.g., coming to the board to correct a sentence), long videos, and independent work on long-term projects (e.g., sessions 11, 14, and 23-28; 8%, 2%, and a mean of 8% AET respectively).

Like the target student, the other students in this class had high AET scores during in-class activities (e.g., session 15; 67% AET) and low scores during long videos and classmates' presentations (e.g., session 14 and 28; 0% AET), but they were more engaged than the target student during independent work time when students were working on their career projects (e.g., session 22; 63% AET).

Target Student B1

A visual inspection of target student B1's AET scores indicates that the level of engagement did not increase with the increased level of UDL implementation (see Figure 13). The student's highest AET scores occurred during sessions where in-class work was assigned and supported (e.g., session 26; 50% AET) and when the classroom paraprofessional implemented proximity control and provided individualized instruction (e.g., session 3; 58%

AET). The student's lowest scores occurred during sessions where the learning activities contained frequent lulls (e.g., session 30; 2% AET) and during sessions in which the learning activity and goal were open-ended (e.g., session 31; 1% AET), which was how Teacher B chose to implement options for assessing the learning goal during UDL lessons.

Target Student B2

A visual inspection of target student B2's AET scores indicates that the level of engagement did not increase with the increased level of UDL implementation (see Figure 13). Observations revealed fleeting moments of AET, but no clear pattern emerged that would describe what types of activities seemed to be engaging for this student. During all lessons, the student walked around the classroom, talked loudly while the teacher was teaching, and antagonized peers by pretending to kick or hit them, or by knocking things off their desks. The student was frequently dismissed from the classroom to the library or the office. During the teacher's attempt at UDL learning activities, this target student would become engaged for a few minutes and then revert to previous behavior.

Because peer comparison data were collected from students located within the camera frame for each target student, the pool of peers for each target student was different. Like the target students, the level of engagement for the other students in the classroom did not increase with the implementation of UDL lessons. The highest peer AET scores occurred during sessions where in-class work was assigned and supported (e.g., sessions 10 and 26; 67% AET) and during teacher-directed interactive activities (e.g., sessions 8 and 16; 58% and 71% AET). Like target student B1, the lowest AET scores for peers occurred during sessions where the only one student was called to the board at a time to solve a problem (e.g., session 6; 13% AET), when learning activities contained frequent lulls (e.g., session 30; 13% AET), and during sessions in which the

learning activity and goal were open-ended (e.g., session 32; 0% AET). Not surprisingly, both Target Students B1 and peers' engagement were impacted negatively by the disruptive behavior of Target Student B2 and the chaotic classroom atmosphere, which seemed to worsen with each of the final days of the school year.

Target Student C1

A visual inspection of target student C1's AET scores indicates that the level of engagement did not increase as UDL lessons were attempted (see Figure 13). The student's highest AET scores occurred during sessions where in-class work was assigned and supported (e.g., session 11; 62% AET) and during activities where there was a clear expectation for a task (e.g., session 28; 54% AET). For example, during a test review, students were required to write down certain questions and answers to study. The student's lowest AET scores occurred during whole group discussions, students reading aloud, long videos, and peer grading (e.g., sessions 12, 13, 16, 23, and 26; 0% AET).

Target Student C2

A visual inspection of target student C2's AET scores indicates that the level of engagement did not increase as the UDL lessons were attempted (see Figure 13). The student's highest AET scores occurred during sessions where in-class work was assigned and supported (e.g., sessions 4 and 33; 74% and 64% AET). During each of these sessions, the target student became more engaged or re-engaged in the tasks after the teacher helped him one-on-one. On one occasion, the student did not understand the directions, but once the teacher explained them individually, the student understood and had no trouble with the task. On another occasion (during the researcher-designed UDL lesson), the teacher provided some direction on what the

student needed to do next to complete his project. With a simple prompt the student was working again and completed the project.

Like the target students, peers in this class were also more actively engaged during sessions where class work was assigned and supported (e.g., session 11; 58% AET) and less actively engaged during long videos and students reading aloud (e.g., sessions 16 and 21; 0% AET).

Target Student D1

A visual inspection of target student D1's AET scores indicates that the level of engagement did not increase significantly with the increased level of UDL implementation (see Figure 13). The student's highest AET scores occurred during sessions where in-class activities were assigned (e.g., session 9; 44% AET) and during sessions where students had options for learning activities (e.g., session 24; 60% AET). The student's lowest scores occurred during student read aloud or silent reading times (e.g., sessions 16 and 17; 0% AET).

The highest AET scores for Target Student D1's peers occurred during sessions where students had choices for learning activities (e.g., sessions 21 and 24; 26% and 55% AET). The lowest AET scores occurred during sessions that included a guest speaker, student read aloud time, silent reading time, journaling, and group discussions (e.g., sessions 3, 10, 16, 17, 18, and 20; 0% AET).

Target Student E1

A visual inspection of target student E1's AET scores indicates that the level of engagement did not increase significantly with the increased level of UDL implementation (see Figure 13). The student's highest AET scores occurred during sessions that required a specific physical task and during sessions that included working on projects (e.g., sessions 15 and 31;

58% and 55% AET). In one session students took notes from a PowerPoint and in another session students worked on projects. The student's lowest AET scores occurred during a test review game when only one student responded at a time (session 12; 2% AET) and during student read aloud time (e.g., session 20; 0% UDL).

Target Student E2

A visual inspection of target student E2's AET scores indicates that the level of engagement increased only slightly with the increased level of UDL implementation (see Figure 13). The student's highest AET scores occurred during sessions that involved working on projects (e.g., session 26; 53% AET) and during presentations when required to complete a task as an audience member (e.g., session 27; 43% AET). During some presentations, students were required to write down the presenter's name and three notes: a fact they learned, a question they thought of, or a suggestion they thought of. The student's lowest scores occurred during partner reading and presentations that did not require a task (e.g., sessions 32 and 33; 0% AET).

Like the target students, peers in this class were more actively engaged during lessons that required engagement in specific tasks (e.g., creating flip books; session 8; 63% AET), lessons that allowed for specific types of peer interaction (e.g., share homework assignment with group and decide on one to share with the class; session 30; 57% AET), and project-based activities (e.g., sessions 2 and 22; 67% and 53% AET). Peers were less actively engaged during student read aloud time, test review games, classmate presentations that did not require a task, and on days where some students had projects completed while others were still working (e.g., sessions 3, 5, 17, 20, and 33; 0% AET).

Although not consistently evident in the data that were collected, both general education students (peer comparisons) and students with behavior problems (target students) displayed

more characteristics of engagement (e.g., sustained involvement, exertion of effort and concentration, and positive emotions; Skinner & Belmont, 1993) during project-based learning activities, during collaborative activities, and during activities that allowed for choices.

Interactive/collaborative activities that had specific directions and a clear focus (e.g., share your thoughts about the article with your group for two minutes) seemed to be enjoyable for students and facilitated active involvement and increased attention. Project-based learning activities that were thoughtfully planned ahead of time (i.e., two or three options for a final product rather than open-ended), and included sufficient supports (e.g., one-to-one help for a student who does not understand the directions) seemed to provoke sustained involvement and students' selection of complex project options. Having limited options for learning activities that were clearly explained, along with behavioral support (e.g., paraprofessional proximity; self-regulation support) and individual assistance either through one-on-one instruction or prompts for planning and organizing (i.e., executive functioning support) seemed most beneficial for students with behavior problems.

Classroom activities that included teacher lecture or demonstrations, group discussions, long videos, student and guest speaker presentations, and students reading aloud resulted in peer comparison students and target students becoming passively engaged (target students with internalizing behaviors), or off-task (target students with externalizing behaviors). Lulls in classroom activities, projects where the task was unclear, and when some students were finished with projects while others were still working resulted in comparison peer students becoming off task (generally by talking with a nearby peer), and target students becoming more disruptive (talking loudly, out of seat, play fighting).

Because the UDL framework seeks to increase active engaged time for all learners (Blamires, 1999; Crawford, 2008; Pisha & Coyne, 2001), one would expect that the BOSS data would indicate increased AET scores as the UDL scores increase. In the present study, this was only evident for one target student (E2). This is likely due to the level of UDL implementation fidelity that was achieved, and also the limited aspects of engagement measured by the BOSS. While four of the five teachers improved UDL implementation over baseline, only one teacher (Teacher E) consistently implemented robust UDL lessons. Although her lessons were aligned with UDL principles, improvement in student engagement was only evident for one target student (E) and the improvement was only minimal compared to baseline (see Figure 21).

With continued implementation of UDL principles, and greater focus on support for executive functioning (AE3) and self-regulation (E3), improvement in student engagement may be realized. Fixsen, Naoom, Blase, Friedman, and Wallace (2005) identify six overlapping stages of implementation that occur in sequence when a new intervention or program is implemented. They report that each stage can take three to four months. Although this study was small with only five teacher participants and 10 weeks of implementation, the program being implemented (UDL) was extensive. In order to gain buy-in from teachers, which would result in greater implementation fidelity, more time may be needed. Once teachers have embraced the UDL framework, as was the case for Teacher E, UDL implementation can begin immediately and with high levels of fidelity. It may take longer to see an improvement in student engagement as students learn the skills necessary to function in a student-centered classroom (i.e., executive functioning and self-regulation).

Social Validity

Research question #3: Do secondary-level general education teachers find UDL to be an acceptable treatment to improve the academic engagement of students with EBD and/or students who are at-risk for academic failure due to behavior problems?

In order to measure the social validity of UDL as a treatment for improving academic engagement in students with EBD or students who are at-risk for school failure due to behavior problems, teachers were asked to fill out a survey upon the completion of this study. All five teacher participants completed and returned the survey. The researcher-created survey was adapted from similar surveys (see Reimers et al., 1991; Witt & Elliot, 1985), and consisted of 22 questions related to all aspects of UDL lesson plan design and implementation. Teachers responded to each question on a 4-point Likert scale where a higher number indicates a favorable response, and a lower number indicates an unfavorable response. The scale for each question was adjusted so that all favorable perceptions of UDL would elicit higher scores and unfavorable perceptions would elicit lower scores. For example, on question number one, *How clear is your understanding of UDL?* a favorable response would be *very clear* (a score of four) and an unfavorable response would be *unclear* (a score of one). On question eleven, *How monetarily costly do you consider UDL implementation to be?* a favorable response would be *not costly* (a score of four) and an unfavorable response would be *costly* (a score of one). The survey questions and the mean and mode responses are listed in Table 5.

Table 5
Social Validity Survey for UDL: Mode, Mean and Range

	Mode	Mean	Range
1. How clear is your understanding of UDL?	4	3.8	3-4
2. How confident are you in your ability to design a UDL lesson?	3	3.4	3-4
3. How confident are you in your ability to implement a UDL lesson?	4	3.6	3-4
4. To what degree is <i>lack of engagement</i> among students with EBD and students who are at-risk for academic failure a concern for you?	4	3.8	3-4
5. Given your concern about <i>lack of engagement</i> among students with EBD and students who are at-risk for academic failure, how acceptable do you find UDL implementation as a remedy for this problem?	3	3.4	3-4
6. How effective is UDL implementation likely to be for your students who have EBD?	3	3.0	2-4
7. How effective is UDL implementation likely to be for your students who are at-risk for academic failure?	4	3.4	2-4
8. How effective is UDL implementation likely to be for typical learners?	4	3.6	3-4
9. How likely are you to suggest UDL to other teachers as a treatment for improving the engagement of students with EBD?	4	3.4	2-4
10. After adequate training, how willing will other teachers be to implement UDL in their classroom?	2	2.6	2-4
11. How monetarily costly do you consider UDL implementation to be?	2, 4	3.0	2-4
12. After initial training and completing the class profile, how much time (in addition to the time you typically spend on lesson planning) will be needed for you to plan UDL lessons?	2	2.4	2-3
13. How much additional training in technology will you require in order to implement UDL in your classroom?	4	3.6	3-4
14. To what extent do you think there might be disadvantages to implementing UDL?	3	2.8	2-3
15. To what extent are undesirable effects likely to result from UDL implementation?	3	3.4	3-4
16. To what extent is UDL implementation uncomfortable for students?	4	3.8	3-4
17. To what extent is UDL implementation uncomfortable for	3	2.6	1-4

teachers?

18. How much do you like UDL as a method for engaging all learners?	4	3.8	3-4
19. How well does UDL fit with your philosophy of teaching and learning?	4	3.8	3-4
20. To what extent is UDL consistent with other interventions used in your classroom?	3	3.2	3-4
21. How willing are you to implement UDL in your classroom?	4	3.6	3-4
22. How willing are you to change your teaching routines to implement UDL?	3	3.4	3-4

Note. Scores based on a four-point Likert scale where low scores are unfavorable responses and high scores are favorable responses.

Mean responses above three could be considered somewhat positive. Several survey questions had responses above three. In fact, 50% of the questions had a mode of four, and 72% of the questions had a mean above 3.0. Five survey questions received a mean score of 3.8 (the highest mean score calculation for this survey): questions 1, 4, 16, 18, and 19. Question four indicates that teachers are concerned about the lack of engagement among their students with EBD and students who are at-risk for academic failure due to behavior problems. Question one indicates that teachers understand the UDL framework. Questions 18, 16, and 19 (respectively) indicate that teachers like UDL as a method for engaging all learners, do not have concerns about UDL being uncomfortable for students, and feel that UDL fits with their teaching philosophies. These and other positive responses on the survey indicate an overall positive response to UDL as a treatment for improving the engagement of students with behavior problems.

Mean responses below three could be considered somewhat negative. Only four survey questions (18%) received a mean score below three: questions, 10 (2.6), 12 (2.4), 14 (2.8), and 17 (2.6). The mode response for question 14 was a three, which indicates that generally teachers did not feel that UDL would be disadvantageous for students, but one teacher marked a two for this question. When asked to elaborate, the teacher indicated that some students are not self-

motivated and would not work independently. This concern could be addressed by implementing UDL with fidelity, as students are likely to be off task if they were told to practice a new skill in any way they would like (e.g., Teacher B's frequently-used method for UDL assessment). When implementing UDL, teachers should construct learning activities thoughtfully with students' strengths, preferences, and interests in mind, and then guide them in reflective learning skills so that they choose the learning activities that best suit their needs (e.g., Teacher A did this by having students choose which part of a worksheet they would do for homework.). UDL also calls for teachers to support executive functioning and self-regulation, which would also address the concern of some students being off task during UDL activities, which tend to afford learners greater freedom.

Two teachers marked low scores for question 17 which asked if UDL implementation might be uncomfortable for teachers. When asked to elaborate, they said that most teachers tend to prefer a more teacher-directed classroom, and having students engaged in a variety of activities at the same time seemed uncontrolled and chaotic, and therefore uncomfortable for teachers. Admittedly, UDL does represent a significant paradigm shift for many teachers. In a seminal article, Guskey (1986) pointed out that staff development leads to a change in classroom practices, which leads to a change in student outcomes, which leads to a change in teacher behavior. In order for this self-reinforcing cycle to begin, and to be sustained, teachers have to work to overcome difficult barriers such as their own aversion to a student-centered classroom environment as well as students' learned helplessness and low tolerance for challenge (Hansen & Stephens, 2000), which often derail well-intentioned teachers from implementing practices learned during professional development.

Teachers marked low scores for question 10 indicating that they did not think other teachers would be willing to implement UDL lessons after training. They explained that most teachers would be resistant because UDL requires more time and effort than doing what they have always done. Teachers also expressed concerns about preparing students for high stakes testing. They were not sure that using UDL-type lessons and assessments would result in higher test scores, and although teachers see benefits to UDL instructional methods, they feel compelled to spend time on academic tasks that are closely aligned with high stakes tests (Pedulla et al., 2003; Smith, 1991).

Teachers also marked low scores for question 12 indicating that they spent more time designing UDL lessons than they spent designing typical lessons. When asked about this, they said that thinking of a variety of ways to do things (e.g., multiple ways to present information, options for learning activities, options for assessments) was difficult and took a lot of time. They also said that finding supports (e.g., supports for understanding and comprehension) was challenging and effortful. Some teachers were less technologically savvy than others and they expressed not only having difficulty with technology, but also having an aversion to it. Many of the supports available to make material more accessible to students are computer-based (or web-based), so teachers who are comfortable with technology do have an advantage (Miranda & Russell, 2012).

This study shows that teachers can design and implement lessons that contain UDL principles after initial training and with on-going coaching on UDL. Teachers A, B, D, and E had zero overlapping data points from baseline to treatment condition, which indicates that the UDL training was effective for them, although it did not appear to be effective for teacher D. Although teacher participants did increase their use of UDL principles from baseline to treatment

conditions, they did not implement UDL lessons consistently and with fidelity throughout the treatment phase. Teacher participants seemed to be most comfortable implementing the aspects of UDL that required minimal effort and adjustment to their existing pedagogy (e.g., adding more options related to materials, and groupings), and they were resistant to aspects of UDL that required additional time in planning (e.g., looking for more ways to present material, thinking of new options for learning activities and assessments, and exploring ways to support executive functioning and self-regulation).

This study further shows that academic engagement does not improve with brief (10-weeks) and limited (low implementation fidelity) exposure to UDL, although involvement, interest, and positive emotions were noted during specific learning activities that had UDL qualities such as interactive activities with a clear focus, and learning activities that allowed for options, and were carefully and thoughtfully planned.

Teacher participants found UDL to be appealing, and thought it to be acceptable as a way to engage all learners, but they expressed concerns about UDL taking additional time for planning, being uncomfortable for teachers to implement, and being ineffective for students who are not self-motivated learners. Because of these concerns, teachers do not think other teachers will be willing to implement UDL after training. Implications of these findings will be discussed in the next chapter.

CHAPTER 5

DISCUSSION

Children and youth with emotional and behavioral disorders (EBD) and those who are at-risk for academic failure due to behavior problems sometimes receive services in special education classrooms, but we know that they must be present in general education classrooms as well because students with EBD are under-identified (Heward, 2009; Kauffman & Landrum, 2009b; T. Lewis et al., 2010). Teachers find these students to be challenging because they repeatedly disrupt the learning environment (Lane, 2007; Wagner et al., 2005), and often require substantial teacher attention due to learning deficits (Cullinan et al., 2003; Cullinan, Osborne, & Epstein, 2004; J. R. Nelson et al., 2003).

Children and youth with behavior problems typically have poor academic outcomes such as failing grades and low graduation rates (Heward, 2009; Landrum et al., 2003). Behavioral problems and lack of academic progress represent a cycle of failure for these students (Payne, Marks, & Bogan, 2007): behaviors keep students from being engaged, and lack of engagement impacts learning. Because engagement leads to academic achievement (Dotterer & Lowe, 2011; Greenwood, 1991; Greenwood et al., 1984; Greenwood et al., 2002; Wang & Holcombe, 2010), it is vital that all students are engaged during academic instruction, including those with behavior problems.

Disruptive behavior can make instruction difficult, especially when effective instructional and behavioral strategies (Burns & Ysseldyke, 2009; Kerr & Nelson, 2010) are neglected because of the common belief among educators that students' behaviors must be under control before instruction can be received (Wehby et al., 2003). Teachers report feeling unprepared to deal with students with behavior problems (Heflin & Bullock, 1999; Westling, 2010), and

seldom use evidence-based practices that are effective for students with EBD (Burns & Ysseldyke, 2009; Cook & Schirmer, 2003; Stormont et al., 2011).

Research suggests that all students benefit from evidence-based instruction and proactive instructional design (Basham et al., 2010) that are responsive to learner strengths and preferences (Tomlinson, 1999) and promote academic engagement (Greenwood et al., 1994). These are key concepts of Universal Design for Learning (UDL), an instructional design framework that calls for teachers to design lessons that are accessible to all students thereby eliminating the need for accommodations and modifications for students with high incidence disabilities (Rose & Meyer, 2002).

UDL calls for teachers to design lessons that incorporate student strengths, interests, and preferences by planning a variety of learning activities and assessment options along with supports for perception, understanding, comprehension, interest, and effort (Rose & Meyer, 2009). In addition to the flexibility and support of instructional materials and lesson plan design, UDL calls for teachers to support students' executive functioning skills and self-regulation skills (CAST, 2011). One would expect, then, that UDL would be an ideal instructional design framework for students with EBD and students who are at-risk for academic failure due to behavior problems because it provides the support they need without their being singled out, and it allows them and all students to maximize their strengths and minimize their weaknesses.

The purpose of this study was to examine the impact of Universal Design for Learning (UDL), implemented as a total framework, on the academic engagement of middle school students with emotional and behavioral disorders (EBD), and students who are at-risk for academic failure due to behavior problems, who are included in general education classes. Three research questions were addressed. First, when provided with professional development on UDL

and UDL lesson plan design, to what degree do secondary-level general education teachers design and implement UDL lessons with fidelity? Second, when compared with non-UDL treatment conditions, does the implementation of UDL in secondary-level, general education, inclusive classrooms result in increased academic engagement for students with EBD and/or students who are at-risk for academic failure due to behavior problems? Third, do secondary-level general education teachers find UDL to be an acceptable treatment for improving the academic engagement of students with EBD and/or students who are at-risk for academic failure due to behavior problems?

Results from research question one indicate that when provided with professional development, teachers can design and implement UDL lessons, albeit with limited robustness and consistency. Results from research question two indicate that brief and limited exposure to UDL is insufficient to produce measureable improvements in student engagement, although an examination of individual data points along with anecdotal notes revealed increased interest and involvement in specific UDL-related learning activities for some target students and peer comparisons. Results from research question three indicate that teachers agree that lack of engagement among students with behavior problems is a concern, and they find UDL to be an acceptable treatment for lack of engagement, but they are somewhat resistant to UDL implementation when they do not have a teaching philosophy that is aligned with UDL to begin with. This chapter will include a discussion of the results for each research question followed by implications for the field of education and future research.

Teachers' Implementation of UDL

Four of the five teachers in the present study increased their implementation of UDL principles from baseline to treatment condition with zero overlapping data points following

professional development on UDL. Professional development consisted of a two-hour individual training session and daily morning coaching sessions before students arrived at school. The finding of the present study, that teachers can increase their use of UDL principles after professional development on UDL, supports a study by Schelly et al. (2011), which revealed that university instructors increased their use of UDL principles following UDL training. It appears that with training alone or training with follow-up coaching, teachers (and university instructors) can increase their use of UDL principles during instruction. Teachers continue to learn about their craft, adjust their thinking, and refine their skills long after they finish their pre-service programs (Borko, 2004), so professional development that promotes best practices is imperative in order to effect change within classrooms and schools (Guskey, 2000).

There is a difference, however, between understanding UDL principles and occasionally implementing them during instruction, and consistently designing and implementing comprehensive UDL lessons. Implementation of comprehensive UDL lessons requires a depth of understanding and skill beyond what is required for implementation of less complex interventions (e.g., increased opportunities to respond via response cards; Kretlow, Cooke, & Wood, 2012). Teacher participants in the present 10-week study had difficulty planning and implementing UDL lessons robustly and with consistent fidelity throughout the treatment phase. Most teacher participants cited lack of time as the main reason for their inability to implement UDL with greater fidelity, but it was evident that some teachers also struggled with certain pedagogical changes that were needed in order to implement UDL lessons successfully. Teachers were also resistant to making the necessary paradigm change that may be required to fully embrace UDL as a teaching philosophy. According to Fixsen et al. (2005), these types of struggles are expected in the initial stages of program implementation, so schools and districts

who wish to implement UDL should be prepared to provide more intensive professional development, coaching, and support during initial implementation.

Lack of Time

It is not unusual for teachers, schools, and districts to give up on a program in the early stages of implementation (Fixsen et al., 2005) because the new program takes significant time and resources to establish, because positive student outcomes are not immediate (Guskey, 1986), or because new innovations come along that seem to be quick fixes for exigent problems (Flanning, 2012; Nichols, Dowdy, & Nichols, 2010). All teacher participants in the present study, at one point or another, mentioned lack of time as a barrier to their ability to implement UDL lessons with greater fidelity. Time was also an area of concern noted on the Social Validity Survey for UDL, which teacher participants filled out upon completion of the study.

It is no secret that teachers struggle to find the time to complete all the tasks related to teaching (e.g., paperwork, faculty meetings, general student management; Ahlgren & Gillander Gadin, 2011; Bruno & Ashby, 2012; Phillip & Kunter, 2013). The one-hour of planning time per day allotted to most secondary teachers (MacBeath, Galton, Steward, Page, & Edwards, 2004) is hardly enough time to plan weekly lessons and grade papers, let alone explore new ideas for learning activities (e.g., read the literature on evidence-based practices, collaborate with colleagues), or learn new skills (e.g., SMART Board usage; website design), both of which may be necessary for initial UDL implementation. The promise of UDL, however, is that once the framework is embraced and understood, and some basic skills have been learned, universally designed lessons will save teachers time and result in more meaningful instruction because time would not be spent modifying lessons and could instead be spent facilitating instruction (Ralabate, 2011).

Resistance to Change

UDL is not an “add-on” that teachers can simply incorporate into their repertoires (e.g., increasing opportunities to respond by using response cards; Kretlow et al., 2012). In order to implement UDL with fidelity, teachers have to be willing to put forth the effort and commitment that is necessary for program implementation (Fixsen, Blase, Metz, & Van Dyke, 2013). Some teacher participants avoided aspects of UDL that required significant additional effort (e.g., learning methods to make materials available for learners outside the classroom, looking for customizable ways to support understanding, seeking alternative learning activities and assessments, learning about executive functioning and self-regulation supports), and attempted to implement aspects of UDL that required less effort (e.g., allowing for choices of materials such as paper or white board, allowing for choices of learning groups such as individual, partners, or small groups). This resulted in lessons that lacked the robustness that is required to be considered comprehensive UDL lessons. A robust UDL lesson includes learning activities, assessment options, and supports that have been thoughtfully and purposefully designed and implemented so that student strengths, interests, and preferences are maximized and weaknesses are minimized (Orkwis & McLane, 1998).

Borko, Davinroy, Bliem, and Cumbo (2000) identified factors associated with teachers’ willingness to change their practices: situational factors (e.g., collaborative relationships with colleagues, resources), personal characteristics (e.g., beliefs about teaching/learning, life events), the interaction of situational factors and personal characteristics, and the delicate balance between beliefs (i.e., what a teacher thinks) and practices (i.e., what a teacher does). These factors contribute to the varied lengths of time that individuals spend at each stage of implementation. A teacher who has effective collaborative relationships with colleagues, for

example, may move easier and more quickly through initial stages of implementation because of the support that is available.

Teacher participants in the present study represent several configurations of these factors. In some cases, life circumstances (e.g., impending retirement, infants at home) prevented teachers from putting forth the effort required for UDL lesson plan development. Teacher D, for example seemed to embrace the concept of UDL, but did not commit additional time toward the development of UDL lessons. In other cases, ineffective collaborative relationships caused newer teachers to defer to the preferences of veteran teachers, which resulted in the newer teachers abandoning their beliefs and not implementing UDL lessons as discussed during coaching sessions.

Although life circumstances made it difficult to devote time and effort to lesson plan development, Teacher E embraced the concept of UDL and produced comprehensive UDL lessons. It should be noted, however, that the pedagogical changes that were necessary for Teacher E were less significant than the changes required for the other teachers, and thus it may have required less time and effort to design and implement UDL lessons. Because the teacher had already been using instructional strategies aligned with UDL principles, she may have already had some established learning activities or lessons that simply needed to be adjusted in order for them to become UDL lessons, whereas the other teachers who had not been using UDL-type instruction would have had to start from scratch. In other words, teacher E was further along in the implementation process than the other teachers. The only weakness in Teacher E's UDL lessons was in the area of support for self-regulation skills. This is an area where, although she performed better than the other teacher participants, she needed to put forth additional effort and/or time in order to design self-regulation supports and implement them with

fidelity. Perhaps the time and effort required was beyond what the teacher was able to commit and therefore this area was somewhat neglected.

Pedagogical Efficacy

Another reason teachers may be reluctant to change pedagogy or have difficulty with innovation implementation is lack of pedagogical efficacy. According to Kunter et al. (2013), pedagogical efficacy includes knowledge (i.e., pedagogical skills, subject-specific knowledge), beliefs (i.e., transmission versus constructivist orientation), motivation (i.e., high self-efficacy and intrinsic motivation), and self-regulation (i.e., ability to cope with stress). When teachers are lacking in one or more of these areas, they may resort to maintaining a path of least resistance and continue with their previous instructional methods (e.g., round-robin reading of chapters, answering section review questions, peer grading) rather than looking for ways to incorporate new innovations such as UDL. Teachers B and C continued to utilize their previous lesson plan formats throughout the treatment phase of the study despite conversations during coaching sessions that encouraged them to adjust aspects of their lesson plans to incorporate UDL principles. Teacher B, for example, planned to include a computer-based program as an option for a learning activity, but in practice, the teacher did not present that option. When asked about it, the teacher reported that it would have resulted in too much chaos in the classroom and would have caused behavior problems. When certain pedagogical skills are lacking, implementation of a new innovation adds to the workload (or stress level) of the practitioner, which may increase resistance.

Many factors must be present in order for teachers to make changes to their instruction and incorporate new innovations: Collaborative relationships and resources must be in place (Borko et al., 2000), beliefs must be in-line with the desired change (Chapman & Heater, 2010),

and life circumstances must permit the allocation of time necessary for information to be absorbed and skills to be learned (Borko et al., 2000). These factors are unlikely to come together spontaneously; so purposeful planning related to professional development is imperative. Professional development may result in initial changes in teaching practices (e.g., presenting material in multiple formats, planning a variety of learning experiences that align to learner strengths, interests, and preferences, providing opportunities for student choice, supporting executive functioning and self-regulation), but these changes are unlikely to be maintained without an accompanying change in paradigm, especially when the change is something as significant as UDL. Professional development in UDL will need to incorporate supports for teachers to begin where they are regarding beliefs and practices and move forward. In the present study, for example, Teacher B may have benefitted from professional development and support in the area of classroom management. Incorporating classroom management strategies (e.g., Mundschenk et al., 2011) may have made it possible to implement the UDL lessons that the teacher talked about during morning coaching sessions with the researcher. Teacher C may have benefitted from professional development and support in the area of lesson planning (e.g., Graff, 2011; K. Jones, Jones, & Vermette, 2011). Helping teachers to develop efficacy and confidence in certain areas (i.e., classroom management, lesson planning) may lead to increased willingness to attempt new pedagogical innovations (Guskey, 1988).

Resistance to Paradigm Shift

Foundational conceptual models or personal beliefs about education and learning, often influenced by their personal experiences as students (E. Peters, 2010), sometimes drive teacher practices. Some teachers lean toward a transmission-style (i.e., teacher-centered approach) of teaching where the focus is on content (Garrett, 2008), and some teachers lean toward a

constructivist-style (i.e., student-centered approach) of teaching where the focus is on metacognition (Laboard Brown, 2003). UDL aligns with the constructivist model, which encourages students to take ownership of their own learning (E. Peters, 2010) rather than depending on the teacher to dispense knowledge. It makes sense, then, that it would be more difficult for transmission-style teachers to implement UDL than for constructivist-style teachers, because transmission-style teachers would first need to overcome their inclination toward teacher-centered instruction and embrace student-centered instruction.

The majority of teacher participants in the present study leaned toward a transmission-style of teaching. The teacher-centered focus was evident by the arrangement of desks in rows facing the teachers' positions in the classroom, and the learning activities during baseline, which consisted of whole-group instruction via teacher lecture or demonstration, student round-robin reading, independent seatwork, and teacher-directed peer grading of homework. Although these teachers conveyed genuine interest and approval of the concept of UDL during training and coaching sessions, they had difficulty with planning multiple methods for representation of the material, and multiple options for learning and assessment activities. This is understandable given the fact that switching to UDL practices would also mean a change in pedagogy and a shift in paradigm for these teachers. According to Fixsen et al. (2005), full implementation of a new innovation can take years, so the small steps toward UDL implementation taken by the teachers in the present study are what would be expected during initial implementation (Fixsen et al., 2005; Joyce & Showers, 2002), which is an awkward time when teachers may be fearful of change (Fixsen et al., 2005) and revert to more comfortable practices.

One teacher participant tended toward a constructivist-style (Wilson, 1996) of teaching as evidenced by the arrangement of student desks in pods of five or six students facing each other,

and the learning activities, which involved group, partner, or independent projects. The teacher only needed to make minor adjustments to her instruction in order to plan for multiple methods of representation of the material, and multiple options for learning and assessment activities. Implementing UDL practices did not require a paradigm shift for Teacher E, but merely required simple changes in pedagogy. In other words, Teacher E was further along on the road of UDL program implementation (Fixsen et al., 2005) than the other teachers in the study.

Despite the obvious difference in the ability of Teacher E to design and implement UDL lessons (as evidenced by significantly higher and more consistent UDL scores), a difference in student engagement between Teacher E's target students and the other student participants was minimal with only a slight improvement for one target student. The lack of increased engagement for Teacher E's students is likely related to lack of support for executive functioning and self-regulation, which are discussed below.

Student Engagement and UDL

Student participant data revealed that brief and limited exposure to UDL is insufficient to produce measureable improvements in student engagement. Only one target student had slight increases in engagement, but examination of individual data points and anecdotal notes revealed increased interest and involvement during specific UDL-related learning activities for other students as well. Student participant data were collected using the Behavioral Observation of Students in Schools (BOSS; Shapiro, 2011a). The BOSS is an observation code that uses momentary time sampling and partial interval recording to examine academic engagement and teacher directed instruction during classroom activities. According to the BOSS, academic engagement includes behaviors such as reading aloud, writing, and talking about the subject matter at hand. As described in Chapter Three, data were collected at 15-second intervals for the

duration of each lesson throughout all lesson components from the time that the teacher called the class to order until the teacher prompted the students to move to another subject or activity.

The hypothesis of the present study was that UDL implementation would result in increased active engaged time (AET), according to the BOSS. Results revealed that student participants' levels of active engagement did not increase as UDL lessons were implemented. This may be because the lessons implemented by teacher participants lacked implementation fidelity and robustness (i.e., activities, options, and supports that have been thoughtfully designed so that student strengths are maximized and weaknesses are minimized), and UDL supports for executive functioning and self-regulation (e.g., help with planning how to approach and manage a task, and help with managing behavior) were in short supply. Active engagement is increased when students are involved in academic tasks that relate to them personally (Marks, 2000), and when they are provided with supports for managing their attention and behavior (Cook et al., 2003; Mundschenk et al., 2011; T. Scott et al., 2007; Sugai & Horner, 2008; Zimmerman, 1998). Lessons that have not been purposefully and thoughtfully designed to engage students and support their learning (the primary principle of UDL) will result in lower levels of engagement.

The positive results of UDL lessons or UDL principles incorporated into some lesson components may not have been evident in the data that were collected because the tool used to collect the data (BOSS) does not take certain aspects of engagement into consideration.

According to the BOSS, writing answers on a worksheet and reading aloud from a textbook indicate active academic engagement because students would be observed writing and reading (Greenwood et al., 2002; Shapiro, 2011b). Skinner and Belmont (1993) suggest characteristics of engaged learners that are not as easily observed (e.g., sustained involvement, selection of

difficult tasks, exertion of effort and concentration, and positive emotions), but may provide a more appropriate lens from which to gauge engagement during complex academic tasks such as projects. If the BOSS is used to collect data during project-based activities, the data may indicate that students are off-task more frequently due to the less structured environment (especially if executive functioning supports and self-regulation supports were not available) when actually students may be more meaningfully engaged than when they are writing on a worksheet or reading a chapter aloud. Collecting data on student engagement during complex tasks (i.e., group or individual project) may require looking at more complex aspects of engagement (i.e., involvement, effort, concentration; Skinner & Belmont, 1993) in order to accurately assess the quality of engagement.

Treatment Fidelity

A robust UDL lesson includes: a variety of ways for students to perceive the information (e.g., lecture, demonstration, video clips, models, digital text); a variety of supports for understanding and comprehension (e.g., embedded vocabulary support, text-to-speech software); options for learning activities and assessments that are aligned with learner strengths, interests, and preferences; supports for executive functioning and self-regulation (e.g., goal setting and follow-up support for learning and behavior); and supports for interest and effort (e.g., connections to learner interests and frequent feedback) (Orkwis & McLane, 1998). Teacher B did not adhere to UDL principles, and thus implemented UDL lessons with low fidelity. For example, the teacher attempted to meet the criteria for UDL by allowing students to choose between paper and individual white boards during guided practice. This allowance for choice was of no consequence to the learners, as it had nothing to do with their strengths, interests, or preferences. Teacher E did adhere to UDL principles, and thus implemented UDL lessons with

high fidelity. Allowing students to choose from several learning activities that were aligned with their strengths, interests, and preferences met the criteria for UDL. Students could choose from project options that incorporated artistic abilities and preferences, computer abilities and preferences, musical abilities and preferences, or even performance abilities and preferences. When interventions, treatments, or programs are not implemented with fidelity, it is impossible to know whether they are effective for treating the problem (Lane & Beebe-Frankenberger, 2004). Implementation fidelity is important because the lack of implementation fidelity could result in treatments being overlooked as a viable option for improving outcomes (e.g., the teacher does not implement the treatment with integrity and decides that it is not effective), treatments producing less than expected or potential gains (e.g. the teacher does not implement the treatment with integrity and only minimal gains or gains for only certain students are possible), or treatments causing harm rather than good (e.g., the teacher does not implement the treatment with integrity and as a result valuable instructional time is wasted or positive outcomes are decreased) (Lane & Beebe-Frankenberger, 2004). If not thoughtfully planned and implemented with high fidelity, not only will instructional time be wasted, but all that UDL has to offer will be lost as well.

Supports for Executive Functioning and Self-Regulation

Just as there is considerable variance among learners' academic skills (Tomilnson, 2004), there is also wide variance among learners' executive functioning skills and self-regulation skills. The UDL elements of support for executive functioning and support for self-regulation are critical for UDL implementation, but in the present study, even when the lessons implemented by teacher participants approached comprehensive levels of UDL, these elements were lacking. Teachers tended to rely on general classroom management strategies to support

executive functioning. They provided verbal prompts to the class for time management, outlined steps in a process, or provided verbal prompts to return to the task at hand. They did not help students to set personal learning goals or help them monitor their progress toward goals. Teachers also tended to rely on general classroom management strategies to support self-regulation. They provided verbal prompts for displaying appropriate behavior toward teachers and peers, or implemented class-wide behavior management systems (e.g., move clips on a chart and lose privileges for inappropriate behavior). They did not help students set personal behavioral goals, help them monitor their progress toward achieving the goals, and provide them with skills to reflect on their behavior.

Even when encouraged to add these supports (e.g., help students set specific goals and monitor their progress; Westling, 2010), teachers seemed to avoid them. It was obvious that teachers were more comfortable with the other UDL elements (e.g., presenting material in multiple ways, offering choices), and chose to focus efforts there. Finding more ways to present material (multiple means of representation) and thinking of alternative learning activities and assessments (multiple means of action and expression), although time intensive, are tasks with which teachers are comfortable. The idea of contemplating new instructional strategies, whether they are actually implemented or not, is not particularly aversive. Supporting executive functioning skills and self-regulation skills, however, can seem somewhat ambiguous and difficult to teachers (Dignath van Ewijk & van der Werf, 2012), especially if they are not familiar with the concepts (Westling, 2010). This is an area that needs to be more prevalent in pre-service training and in-service professional development, whether UDL is implemented or not, so that students can purposefully apply knowledge and engage in high-order skills as indicated in the Common Core State Standards Initiative (CCSS, 2012).

Because a student-centered (Gallavan & Kottler, 2002; Lee Harris, 2000; Movitz & Holmes, 2007; E. Peters, 2010), UDL-type classroom is not typical, most students have not been exposed to it and, therefore, do not understand their role in such a setting (E. Peters, 2010). Explicit instruction on executive functioning skills and self-regulation skills will help students adjust to new expectations (Friesen, 2008; Johnson & Reid, 2011). Jewell Cooper, Horn, and Strahan (2005) found that explicitly teaching and incorporating self-regulation skills into lessons over a long period of time helped students to acquire them. For example, planning for and building-in successful learning experiences helps students make the decision to persevere longer on the next task. Planning lessons that incorporate student strengths, interests, and preferences while providing built-in supports gently pushes students toward deeper knowledge and reflective learning.

Both teachers and students find it difficult to address executive functioning skills and self-regulation skills. Teachers are often unfamiliar with the concepts, and students lack the skills. In order to address this area of UDL teachers may need training on executive functioning and self-regulation and how to teach the related skills to students, and students will need explicit instruction along with continued support in order to demonstrate the skills independently.

Patterns of Engagement

Despite the lack of overall increase in student engagement during the present study, a close inspection of individual data points in conjunction with video recorded observations and anecdotal notes revealed some specific patterns of engagement that corroborate other research (e.g., Gasser, 2011; Guthrie & Cox, 2001; Schraw, Flowerday, & Lehman, 2001) that suggests that students are more engaged during learning activities that promote continuous and active student involvement. Students in the present study appeared to be more interested in lessons that

were project oriented and incorporated collaboration and choices, although they were easily distracted during these activities due to movement around the classroom and lack of support for executive functioning and self-regulation.

Problem-based learning activities and project-based learning activities (see Driscoll, 2005) implemented by Teacher E seemed to result in greater student interest and participation. Target students and non-target students demonstrated greater involvement and concentration during independent work time on projects than they did during learning activities where students took turns reading aloud or during times when the teacher was lecturing. This would be expected given the literature on problem-based and project-based learning (English & Kitsantas, 2013; Yilmaz, 2011), which indicates that learners are more engaged during these types of activities (Lattimer & Riordan, 2011) as they learn new information and acquire new skills while finding solutions to authentic problems. Similarly, when teacher D allowed students to choose from assignment options (e.g., create a character dialogue with a partner or answer questions from a worksheet), the target student appeared to be more interested than during assignments where students read aloud or watched a video. This would be expected given the literature on choice (P. Denton, 2005; Jolivet, Wehby, Canale, & Massey, 2001), which indicates that choice increases motivation and effort. Although the higher levels of engagement were not indicated according to the BOSS criteria, characteristics of engagement such as sustained involvement, selection of difficult tasks, exertion of effort and concentration, and positive emotions (Skinner & Belmont, 1993), discussed above, seemed to be present in target students and non-target students during UDL-type activities.

Teacher Acceptability of UDL

Teacher participants in the present study completed a Social Validity Survey for UDL (see Appendix F) upon completion of the study. The survey consisted of 22 questions related to aspects of UDL lesson plan design and implementation.

Results of the survey indicated that teachers agreed that lack of engagement is a problem among students with EBD and students who are at-risk for academic failure due to behavior problems. They indicated that, after UDL training, they understood the concept of UDL and felt somewhat confident in their ability to design and implement UDL lessons. They agreed that UDL is an effective treatment for improving engagement for all learners (including those with behavior problems), and indicated that it fit with their existing teaching philosophies and that they would be willing to implement UDL in their classrooms. Teachers did not feel that UDL would be uncomfortable for students, but they thought it could be disadvantageous for students who are not self-motivated. Teachers also indicated that UDL lesson planning took more time than their usual lesson planning, that implementing UDL lessons may be uncomfortable for teachers, and that they did not think *other* teachers would be willing to implement UDL in their classrooms.

The dichotomy between the sentiments expressed by teachers in the social validity survey represents an example of the gap between beliefs and practices mentioned previously (Borko et al., 2000; Chapman & Heater, 2010). Teachers indicated that they *believe* in the promise of UDL as a remedy for disengagement, but *in practice* they had difficulty making changes in pedagogy, especially when it required a paradigm shift. Some of them actively resisted the changes required (Cuban, 2001; Vaughn, Klingner, & Hughes, 2000) for UDL implementation or regressed to previous teaching behaviors despite professional development and coaching. These

behaviors are not unusual when implementing significant innovations (Fixsen et al., 2005) and they make the case for recursive practice opportunities and ongoing professional development when implementing a new intervention or framework such as UDL.

When contacted the following school year, Teachers A and E indicated that they continue to implement UDL principles in their daily lessons and feel that UDL benefits all students. In response to a follow-up question regarding the impact of UDL on target students, Teacher E said, “kids are more accepting of different kids doing different things, which makes the students with IEPs blend in more, and feel more accepted”. Teacher B indicated that she did not continue to implement UDL principles the following year due to time constraints, but she does attempt to incorporate more movement in the classroom, which she feels engages learners. Although Teacher B does not implement UDL as a framework currently, she may be taking a step toward UDL implementation or toward a paradigm shift by implementing “more movement” in the classroom as this may help her to become more comfortable with a less teacher-centered and more student-centered classroom environment.

Limitations

Some limitations should be considered when interpreting the results of this study. First, a convenience sample of five middle school teachers and eight middle school students in the Midwest was used. Because the samples size was small and only middle school teachers and students were represented, results cannot be generalized to the greater population geographically or to elementary or high school students and teachers. Additionally, target students were selected based on the special education disability category of EBD, or another disorder characterized by inappropriate behavior and difficulty in school due to behavior (e.g., ADHD, ASD) or because they were considered to be at-risk for academic failure due to behavior

problems. Data were not collected on students with other disabilities (e.g., learning disability) or students identified as general education students. Therefore, the results cannot be generalized to other disability categories or populations.

Second, although data collection via video recording resulted in high inter-observer agreement due to the ability to pause and rewind recordings to collect accurate data, it did limit the vantage point of the observer. An actual observer in the classroom would have been able to move around the room to gain a more thorough understanding of student activities.

Third, although both tools developed for the present study were based on related tools and extant research (Basham & Gardner, 2010; Morrissey, 2008; Reimers, Wacker, & Koepple, 1987; Witt & Elliot, 1985), and are considered by the researcher to be valid tools for measuring UDL implementation and UDL social validity, neither tool has been used in conjunction with existing tools in order to test their reliability.

Fourth, the study took place during the final 10 weeks of the school year, which included days when end-of-the-year activities such as field days, field trips, assemblies, and parties disrupted schedules and made it difficult for teachers to implement lessons that lasted multiple days. Additionally, teachers submitted final grades approximately one week before the final day of the study. Students were aware that all lessons after a certain point would not impact grades, which may have decreased effort.

Implications for the Field of Education and Future Research

It appears that teachers like UDL and want to implement UDL principles in their classrooms, but like any innovation in education, teachers need training and support in order to do so. Although individual teachers may try to implement UDL in isolation, it is unlikely that UDL will be sustainable without a change in the school culture and paradigm shifts among

educators in the school (Fixsen et al., 2013). Professional development for UDL will need to be extensive and on going rather than a one-shot workshop. It will need to address some basic competencies (e.g., lesson planning), and ultimately assist schools and districts to cultivate their own UDL leaders and communities of learners. Professional development will also need to help teachers to teach students how to function in student-centered classrooms.

In order to determine if UDL is an effective method for improving engagement, it will need to be measured. Teachers and supervisors can use the tool developed for this study to determine the level of UDL implementation fidelity present during a lesson, and to help them identify areas for improvement and further professional development. The BOSS is a somewhat sufficient tool for measuring student engagement during UDL lessons, but it doesn't capture certain characteristics of engagement that may provide a more accurate picture of engagement during UDL lessons.

A restructuring of the UDL framework may make its overlooked elements of support become more prominent. Supports for executive functioning and self-regulation were difficult for teachers to implement throughout the present study. This demonstrates the need for a better understanding of these principles, how they fit into the UDL framework, and how crucial they are for the success of UDL implementation.

Professional Development

Teacher participants in the present study and teacher participants in related studies on UDL (Dymond et al., 2006; Friesen, 2008; Kortering et al., 2008) as well as workshop attendees (Edyburn, 2009) have indicated that they easily embrace the concept of UDL and see the potential benefits of UDL for all students. Teachers often express an affinity for a particular educational innovation (e.g., differentiated instruction), and attempt to implement it, but then

revert to their usual way of doing things (Cuban, 2001; Vaughn et al., 2000) if the innovation becomes complicated, is not embraced by colleagues (De Jong, 2012), does not show immediate results (Guskey, 1986), or when supports are not available (Fixsen et al., 2013). Professional development that includes teacher feedback, collaboration, and on-going support is critical if UDL is to be implemented with fidelity and sustained in a school or district (Birman et al., 2000; Kratochwill et al., 2007).

The core features of effective professional development include: an emphasis on content knowledge (i.e., subject matter and pedagogy), active learning (i.e., teacher involvement), and coherence (i.e., alignment with other reform efforts) (Birman et al., 2000; Desimone, 2011b; Garet et al., 2001). The professional development provided for teacher participants in the present study incorporated these key features. Teachers received training on how to design and implement UDL lessons, and they were active participants as they immediately applied the principles they learned directly in their classrooms on current lessons. The training was coherent with other initiatives being implemented in the school (e.g., co-teaching, common core state standard initiatives). Four of the five teachers, however, needed more support than they were offered for this study. C. Denton, Vaughn, and Fletcher (2003) report that prompt, specific, and continuous feedback is required if teachers are to sustain new teaching practices following professional development. On-site coaching during the school day would have made this immediate feedback possible and may have helped some of the teachers to implement UDL with greater fidelity. Given that resources are limited and that the allocation of resources is often based on student outcomes it is unlikely that sufficient support for UDL implementation could be procured from outside the school or district for most schools. Nevertheless, UDL can still be implemented on a small-scale or large-scale basis (see Muller & Tschantz, 2003). In some

states, UDL professional development efforts included sending selected administrators and teachers to CAST headquarters for training, which they then brought back to their school districts.

Rose and Meyer (2009) suggest that schools use a collaborative model of professional development called the lesson study model (C. Lewis, Perry, Hurd, & O'Connell, 2006; C. Lewis, Perry, & Murata, 2003) in which teachers plan, analyze, and refine their UDL lessons together. One benefit of this collaborative model is that it may improve the use of class learning profiles (forms on which teachers list students' strengths, weaknesses, interests, and preferences as they relate to the lesson being planned; Rose & Meyer, 2002) and lesson plans because teachers involved would experience a healthy accountability within their collaborative relationships, which would prompt them to put all the required aspects of UDL implementation into practice.

Teacher participants in the present study did not utilize the class learning profiles and did not write detailed lesson plans during baseline, or after training sessions, which included training on the class learning profile and a particular lesson plan format (backward design; McTighe & Thomas, 2003) that works well with UDL. Writing lesson plans in a particular format and using the class learning profiles were not requirements for participation in this study because secondary-level teachers frequently have a set lesson plan for each week of the school year that is used from year to year, and it was suspected that such a requirements would result in resistance from potential participants. Unfortunately, without the requirement for lesson plans to be completed in a specific format, teacher participants wrote sparse lesson plans that consisted of words and phrases (e.g., read pages 22-32), or chapter and section numbers from textbooks (e.g., 5-2, 5-3). None of the teachers included learning goals, assessment methods, or learning

activities related to student characteristics in their lessons plans during baseline or after training, even though they were trained on these aspects of UDL lesson planning during the individual training sessions.

Another benefit of teachers working together and collaborating, as Rose and Meyer suggest, is that teachers who are less competent, or novices with UDL techniques can benefit from the expertise of teachers who have previous experience with UDL-type lessons. Because Teacher E had already been implementing project-based learning activities, she had the opportunity to “work out the kinks”. For example, she knew that a certain level of structure would need to be applied during UDL learning activities. The teacher did not let students self-select their groups and partners on every occasion, and she learned that using the same rubric for grading all project options would make grading easier. In a collaborative atmosphere, Teacher E would have been able to share this knowledge with other teachers who implement UDL.

Dunn et al. (2010) suggest that teachers continue to teach they way they have always taught because their lesson plans do not include options for diverse learners. In other words, in order to make a change, one must plan for it. In order to make a change in the classroom, teachers must plan for it via lesson plans. In order to make a change in a school, administrators must plan for it via professional development. In order for change to occur in the field of education, teacher education programs must plan for it by helping new teachers to establish beliefs and learn practices that are aligned with high levels of student engagement.

Schools and districts that would like to implement UDL will need to begin with professional development. For UDL to be implemented district- or school-wide, a shift in school culture and individual teacher paradigms will have to occur. A realistic starting point may be to focus on one principle of UDL at a time and provide professional development that includes

specific strategies that relate to content areas, and existing initiatives. For example, in a school district where the technology is available in each teachers' classroom (as was the case for the schools in the present study) the focus could be on their learning how to utilize SMART Board technology so they could present material in multiple ways (the first principle of UDL). Another topic could be on learning how to support executive functioning and self-regulation skills because UDL is unlikely to be implemented robustly and with fidelity without explicit instruction to help students function in student-centered classrooms and to become reflective learners.

Future research should explore UDL implementation and professional development. Because UDL is not a simple intervention that can be learned, practiced, and easily implemented with fidelity by practitioners, it requires professional development befitting the magnitude of the change that is required. Discovering the correct type, intensity, frequency, and duration of professional development will be critical to sustaining the framework.

UDL Measurement

Teachers and administrators are more likely to persevere with an innovation if they see positive outcomes for students (Guskey, 1986). The tool that was developed for the present study (i.e., UDL Fidelity Tool) and its accompanying scoring tool can be used by teachers or administrators to measure UDL implementation fidelity because the tool provides an overall UDL score as well as a simple way to see where areas of improvement are needed, but the tool does not address student outcomes.

In the present study, the BOSS (Shapiro, 2011b) was used to measure student outcomes related to engagement. The BOSS is a somewhat sufficient tool for measuring some aspects of student engagement when UDL is implemented, but it may be helpful to adjust the codes that are

in place when the tool is used. For example, copying notes from a PowerPoint would be considered active learning according to the BOSS, but this activity may not be an engaging learning experience for all students. It would be helpful to measure other characteristics of engagement such as sustained involvement, task selection, effort exertion, and positive emotions (Skinner & Belmont, 1993), perhaps via a student survey (e.g., Student Engagement Instrument; Appleton, Christenson, Kim, & Reschley, 2006), modified to include items aligned with UDL principles such as *materials are relevant and interesting*, or *students learn by participating* (B. Greene, Miller, Crowson, Duke, & Akey, 2004), in order to gain better insight into the depth and quality of engagement during UDL-type learning activities.

Future research should explore UDL measurement. Investigating the reliability of the measurement tool developed for the present study would increase the confidence in its ability to measure UDL implementation accurately. Future research should also examine student outcomes when UDL is implemented. The only true way to measure the effectiveness of UDL for students with or without EBD is to determine to what extent it improves academic outcomes. This could be accomplished by providing professional development so teachers can implement UDL with fidelity, and then measuring student achievement through progress monitoring, review of products, and student reflections on the learning process (Swiderski, 2011).

Conceptualizing UDL

The elements of support, which are built-in to the UDL framework, seem to be easily overlooked. Researchers tend to focus on the principles of flexibility that call for teachers to design instruction that allows for multiple means of representation (i.e., present material in multiple ways so all students can accurately perceive, understand, and comprehend it), multiple means of action and expression (i.e., allow for students to interact with the material in multiple

ways through options for learning activities and assessment), and multiple means of engagement (i.e., support students' interest and effort by allowing for students to employ their strengths, interests, and preferences through the choices they make regarding learning activities), and they neglect the elements of support that are included in the UDL framework: support for accessing the material (e.g., decoding support included under the multiple means of representation principle), support for executive functioning (e.g., planning and persevering with a task, which is included under the multiple means of action and expression principle), and support for self-regulation (e.g., maintaining appropriate behavior, which is included under the multiple means of engagement principle). Restructuring the principles of UDL may focus teachers' attention equally on the support elements prompting them to address these elements more effectively. A possible restructuring may involve separating the "support" elements from the "multiple means" elements so there would be four principles of UDL: multiple means of representation, multiple means of action and expression, multiple means of engagement, and multiple means of support. The support elements would focus, as they do now, on ensuring that learners have what they need in order to function in a student-centered classroom environment. Without the elements of support, UDL implementation seems to fall apart because students sometimes lack the skills necessary to plan and approach a task, and maintain appropriate behavior during less structured classroom activities characteristic of UDL lessons.

Future research on UDL should explore the elements of support (i.e., support for executive functioning and supports for self-regulation) and their role in UDL. Perhaps the real power of UDL lies in the support elements because when supports are provided to help students access the information in more meaningful ways they become more engaged and ultimately experience better outcomes (Renzaglia et al., 2003; T. Scott et al., 2007).

Finally, before moving forward with research on UDL professional development, UDL measurement, and restructuring UDL, we need to fully understand UDL and identify what aspects of UDL are responsible for improved outcomes. A component analysis will provide information on the principles of UDL and whether one is more powerful than another for improving learner outcomes. This information will lead to more efficient professional development and more effective operationalization of UDL.

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APPENDICES

Appendix A Teacher Recruitment Flyer

**Would you like to be able to meet the needs
of ALL learners in your classroom at the same time?**

**Would you like to have increased
student engagement in your classroom?**

**If so, please consider participating
in a research study on...**

Universal Design for Learning

In a nutshell, this study will examine the effect that
Universal Design for Learning (UDL) has on student engagement.

Who can participate?

1. You must teach a general education math, English, science, or social studies class.
2. You must have students with disabilities and/or students who are at risk for school failure due to behavior problems included in the class that you teach.

What's in it for you?

1. Learn practical strategies for engaging all learners.
2. Receive individualized training and support on UDL.
3. Earn CPDU's.

**Please plan to meet with me at (TIME) on
(DATE) for more information.**

Kim Johnson-Harris
Doctoral Candidate
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kjharris@siu.edu (###-###-###)



This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Sponsored Projects Administration, SIUC, Carbondale, IL 62901-4709. Phone (618) 453-4533. E-mail: siuhsc@siu.edu.

Moment	106	107	108	109	*110	111	112	113	114	*115	116	117	118	119	*120	S	P	T
AET																		
PET																		
OT																		
TDI																		

Target Student		Comparison Peers		Teacher Directed Instruction	
AET	%	AET	%	TDI	%
PET	%	PET	%		
OT	%	OT	%		
Total Intervals		Total Intervals		Total Intervals	

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Appendix C UDL Fidelity Tool (UDL-FT)

**UDL Fidelity Tool
(UDL-FT)**

Teacher:	School:	Subject:
Date lesson began:	Date lesson ended:	Lesson topic:
Note dates that the target student was not present:		

Directions:

A unit of instruction may have several lessons that are the building blocks of the unit. A lesson may have several parts including various learning activities and experiences. For example, a unit on poetry in language arts may include a lesson on figurative language that spans one or more days and includes several different components. Likewise, a unit on fractions in math may include a lesson on adding fractions that spans one or more days and has several different components. Each lesson is likely to have an introduction, various learning activities and experiences, and an assessment of the lesson objectives.

When filling out this checklist, consider the LESSON JUST COMPLETED. Read each question, check all applicable responses, and provide further explanation as needed.

Although several elements will apply to the instruction provided during this lesson, not all of them will apply. Only mark the indicators that were actually employed, or purposefully made evident and available to students during this lesson.

Each indicator that is marked should be evident from the attached lesson plan **and/or** materials.

Please attach the following items with this completed form:

- ☐ Lesson plan
- ☐ Hard copies of all printed materials

Multiple Means of Representation

R1. How was information represented during THIS lesson?

Check all that apply and briefly explain if necessary.

- | | |
|---|---|
| <input type="checkbox"/> 1. orally _____ | <input type="checkbox"/> 11. digital text _____ |
| <input type="checkbox"/> 2. digital print (e.g., PowerPoint) _____ | <input type="checkbox"/> 12. audio text _____ |
| <input type="checkbox"/> 3. hard copy print (e.g., handouts) _____ | <input type="checkbox"/> 13. Information was readily available for learners to access in advance. _____ |
| <input type="checkbox"/> 4. graphic images _____ | <input type="checkbox"/> 14. Information was readily available outside of class for learners to access independently and/or repeatedly. _____ |
| <input type="checkbox"/> 5. animation/emoticons _____ | <input type="checkbox"/> 15. other (please explain) _____ |
| <input type="checkbox"/> 6. video clips _____ | |
| <input type="checkbox"/> 7. full video _____ | |
| <input type="checkbox"/> 8. video captioning _____ | |
| <input type="checkbox"/> 9. demonstration _____ | |
| <input type="checkbox"/> 10. three-dimensional representation _____ | |

R2. How was understanding supported during THIS lesson?

Check all that apply and briefly explain if necessary.

- ☐ 1. Learners were left to their own devices to understand information as it was represented. _____
- ☐ 2. structure of current text section explained _____
- ☐ 3. vocabulary was pre-taught _____
- ☐ 4. embedded vocabulary support (e.g., hyperlink, footnotes) _____
- ☐ 5. embedded phrase/sentence support (e.g., hyperlink, footnotes) _____
- ☐ 6. decoding support via text-to-speech software _____
- ☐ 7. decoding supported via digital text _____
- ☐ 8. decoding supported via audio text _____
- ☐ 9. Understanding supports were readily available for learners to access in advance. _____
- ☐ 10. Understanding supports were readily available outside of class for learners to access independently and/or repeatedly. _____
- ☐ 11. other (please explain) _____

R3. How was comprehension supported during THIS lesson?

Check all that apply and briefly explain if necessary.

- ☐ 1. Learners were left to their own devices to comprehend information as it was represented. _____
- ☐ 2. background knowledge supplied/activated _____
- ☐ 3. list of key terms and definitions provided _____
- ☐ 4. information chunked into smaller parts and progressively released _____
- ☐ 5. patterns/relationships highlighted _____
- ☐ 6. critical features/big ideas highlighted _____
- ☐ 7. frequent review provided _____
- ☐ 8. prompts or cues for steps in a process provided _____
- ☐ 9. checklists, graphic organizers, concept maps provided and supported _____
- ☐ 10. strategies taught/reinforced (e.g., mnemonics) _____
- ☐ 11. Comprehension supports were readily available for learners to access in advance. _____
- ☐ 12. Comprehension supports were readily available outside of class for learners to access independently and/or repeatedly. _____
- ☐ 13. other (please explain) _____

Multiple Means of Action & Expression

AE1. How did learners interact with the information during THIS lesson?

Check all that apply and briefly explain if necessary.

- ☐ 1. All learners completed all the same learning experiences/activities in the same way. _____
- ☐ 2. Learners had multiple options for learning experiences/activities. _____
- ☐ 3. Cooperative learning groups were used. _____
- ☐ 4. Multiple tools were readily available for learning experiences/activities (e.g., software, manipulatives, multi-media options) _____
- ☐ 5. Learning experiences were aligned with learner strengths, interests, and preferences as indicated on the class learning profile. _____
- ☐ 6. Learners were allowed and encouraged to engage in learning experiences/activities of their own creation and innovation. _____
- ☐ 7. other (please explain) _____

AE2. How did learners express their knowledge/mastery of the information during THIS lesson? Check all that apply and briefly explain if necessary.

- ☐ 1. All learners completed all the same assessments in the same way. _____
- ☐ 2. Formative assessments were planned and implemented to inform instruction. _____
- ☐ 3. Learners had multiple options for assessment activities. _____
- ☐ 4. Multiple tools were available for assessment activities. (e.g., software, manipulatives, multi-media options, models) _____
- ☐ 5. Assessment options were aligned with learner strengths, interests, and preferences as indicated on the class learning profile. _____
- ☐ 6. Learners were allowed and encouraged to engage in assessment activities of their own creation and innovation. _____
- ☐ 7. other (please explain) _____

AE3. How was learners' executive functioning supported during THIS lesson?

Check all that apply and briefly explain if necessary.

- ☐ 1. Learners were left to their own devices regarding reflective learning skills. _____
- ☐ 2. Learners were supported in managing their time during this lesson. _____
- ☐ 3. Learners were supported in managing their workspace during this lesson. _____
- ☐ 4. Learners were supported in employing effective attention skills during this lesson. _____
- ☐ 5. Learners were supported in setting personal learning goals for this lesson. _____
- ☐ 6. Learners were supported in planning how to accomplish personal learning goals for this lesson. _____
- ☐ 7. Learners were supported in organizing materials, resources, and tools to accomplish personal learning goals for this lesson. _____
- ☐ 8. other (please explain) _____

Multiple Means of Engagement

E1. How were learners' interests supported during THIS lesson?

Check all that apply and briefly explain if necessary.

- ☐ 1. Learner interest in learning activities and experiences was incidental rather than planned. _____
- ☐ 2. The relevance of the learning goal for this lesson was emphasized. _____
- ☐ 3. The value of the learning goal for this lesson to individual learners was established. _____
- ☐ 4. New topic was connected to learners' existing interests. _____
- ☐ 5. Learners had choices for how the learning goal was achieved. _____
- ☐ 6. Learner choices for learning activities/experiences were aligned with learner strengths, interests, and preferences. _____
- ☐ 7. other (please explain) _____

E2. How was learners' effort supported during THIS lesson?

Check all that apply and briefly explain if necessary.

- ☐ 1. Learner effort was not purposefully supported. _____
- ☐ 2. The importance of the learning goal was emphasized. _____
- ☐ 3. Feedback was frequent, timely, and specific. _____
- ☐ 4. Feedback for this lesson attributed successes/failures to events within learners' control. _____
- ☐ 5. Feedback pointed out where learner(s) went from not knowing to knowing. _____
- ☐ 6. Feedback pointed out where learner(s) effort resulted in success. _____
- ☐ 7. Feedback emphasized effort/improvement rather than grades. _____
- ☐ 8. Feedback was aligned with learner strengths, interests, and preferences. _____
- ☐ 9. The degree of difficulty or level of support was adjusted to promote individual student success and increase desire to put forth effort. _____
- ☐ 10. other (please explain) _____

E3. How were learners' self-regulation skills supported during THIS lesson?

Check all that apply and briefly explain if necessary.

- ☐ 1. Learners were left to their own devices to manage their emotions and behavior. _____
- ☐ 2. Learners were supported in managing their emotions. _____
- ☐ 3. Learners were supported in managing behaviors. _____
- ☐ 4. Learners were supported in managing their environment. _____
- ☐ 5. Learners were supported in setting personal behavioral goals. _____
- ☐ 6. Learners were supported in selecting and using personal behavioral strategies. _____
- ☐ 7. Learners were supported in self-monitoring behavioral progress. _____
- ☐ 8. Learners were supported in reflecting on behavioral outcomes. _____
- ☐ 9. other (please explain) _____

Appendix D UDL Fidelity Scoring Tool

UDL Fidelity Scoring Tool

		0	1	2	Totals
M M R	R1.	If only 1,2, and/or 3 are checked, score 0.	If multiple items from 1-10 are checked, but <i>none</i> from 11-14, score 1.	If <i>any</i> items from 11-14 are checked <i>in addition to</i> any items from 1-10, score 2.	
	R2.	If item 1 is checked, score 0.	If items 2 and/or 3 are checked, but <i>none</i> from 4-10, score 1.	If <i>any</i> items from 4-10 are checked, score 2.	
	R3.	If item 1 is checked, score 0.	If any items from 2-10 are checked, but <i>not</i> items 11 or 12, score 1.	If items 11 and/or 12 are checked <i>in addition to</i> any items from 2-10, score 2.	
M M A & E	AE1.	If item 1 is checked, score 0.	If any items from 2-4 are checked, but <i>not</i> items 5 or 6, score 1.	If items 5 and/or 6 are checked, score 2.	
	AE2.	If item 1 is checked, score 0.	If any items from 2-4 are checked, but <i>not</i> items 5 or 6, score 1.	If items 5 and/or 6 are checked, score 2.	
	AE3.	If item 1 is checked, score 0.	If any items from 2-7 are checked, but <i>not ALL</i> items from 5-7, score 1.	If <i>ALL</i> items from 5-7 are checked, score 2.	
M M E	E1.	If item 1 is checked, score 0.	If item 2 is checked, but <i>not any</i> items from 3-6, score 1.	If <i>any</i> items from 3-6 are checked, score 2.	
	E2.	If item 1 is checked, score 0.	If any items from 2-7 are checked, but <i>not</i> items 8 or 9, score 1.	If items 8 and/or 9 are checked, score 2.	
	E3.	If item 1 is checked, score 0.	If any items from 2-8 are checked, but <i>not ALL</i> items from 5-8, score 1.	If <i>ALL</i> items from 5-8 are checked, score 2.	
				A minimum of seven elements must be indicated from this column in order for the unit to be considered a comprehensive UDL unit.	<div> <div>___/18</div> <div>___%</div> </div>

Appendix E UDL Professional Development Validity Checklist

UDL Professional Development Validity Checklist

Directions: Check each item that was addressed during the professional development session.

	Addressed	Not Addressed
UDL origin		
UDL conceptual underpinnings and related brain research		
UDL principles		
UDL and technology		
UDL and students with EBD		
UDL lesson plan design		
Collaborative lesson plan design session		

Percent Agreement _____

Appendix G Teacher Participant Consent Form

2/19/13

Dear _____:

I am a graduate student seeking my Doctor of Philosophy degree in the Department of Educational Psychology and Special Education at Southern Illinois University Carbondale.

The purpose of my research is to examine whether training teachers in Universal Design for Learning (UDL), an instructional design framework, will improve the academic engagement of students with behavior disorders or students who are at-risk for academic failure due to behavior problems. **This research may result in improved instruction and increased academic engagement for your students and other middle school students.**

As a teacher participant, you will be trained in UDL and will implement UDL lessons. In order for me to see the lessons that you implement during the study, video recorders will be set up in your classroom during one 50-minute class period (e.g., math, English, science, or social studies) each day for approximately 12 weeks. The video cameras will record lessons and student responses to the lessons. I will view the recordings after the school days to see how you implemented the lessons and to collect data on how students responded to the lessons.

You will not be identified by name on any materials related to this study and all video recordings and other materials will be secured in locked cabinets when not in use. Video recordings will be viewed by only my self, my SIUC supervising professor, and a research assistant. Upon completion of the research study, all recordings and related materials will be destroyed.

There are no foreseeable risks or discomforts to teacher participants or student participants, as the treatment seeks to only enhance existing instruction and improve the engagement of all students in your class. Participation in the study will require approximately three hours of your time for training as well as additional time for UDL lesson plan development throughout the study.

Your participation in this study is voluntary. Refusal to participate in this study will not result in any penalty or loss of benefit to which you are entitled. You may discontinue participation at any time without penalty or loss of benefits to which you are entitled. Your signature on this form indicates your voluntary consent to participate in this study.

I have read the information above. I understand by signing this form, I agree to participate in this research study by setting up video equipment and recording daily lessons, participating in professional development on UDL, developing and implementing UDL

lesson plans, submitting copies of UDL lesson plans to the researcher, completing fidelity checks for each UDL lesson plan, and completing a treatment acceptability survey.

Printed Name

Signature

Date

My signature below indicates my consent to video record me FOR ONE 50-MINUTE CLASS PERIOD EACH DAY FOR APPROXIMATELY 12 WEEKS for this study.

Signature

Date

Questions about this study can be directed to me or to my supervising professor, Dr. Nancy Mundschenk, Department of Educational Psychology and Special Education, SIUC, Carbondale, IL 62901-4618.
Phone (618) 453-1810.

Thank you for taking the time to assist me in this research.

Kim Johnson-Harris
XXX-XXX-XXXX
kjharris@sui.edu



This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Sponsored Projects Administration, SIUC, Carbondale, IL 62901-4709. Phone (618) 453-4533. E-mail: siuhsc@siu.edu

Appendix H Parent/Guardian Consent Form

2/19/13

Dear _____:

I am a graduate student seeking my Doctor of Philosophy degree in the Department of Educational Psychology and Special Education at Southern Illinois University Carbondale.

The purpose of my research is to examine whether training teachers in Universal Design for Learning (UDL), a type of lesson plan design, will improve students' academic engagement. **This research may result in improved instruction and increased engagement for your child and other middle school students.**

Your child's teacher will be trained in UDL and will implement UDL lessons. In order for me to see the lessons that the teacher implements during the study, video recorders will be set up in your child's classroom during one 50-minute class period (math, English, science, or social studies) every day for about 12 weeks. The video cameras will record lessons and student responses to the lessons. I will look at the video recordings after the school days to see how the teacher implemented the lessons and to collect data on how students responded to the lessons.

As a student participant, your child will not be asked to do anything extra. He or she will simply participate in lessons conducted by the teacher. Your agreement to allow your child to participate means that it is ok for your child to be video recorded, ok for me to collect data on how your child responds to lessons, and ok for me to examine your child's school records. Your child's name will not be identified on any of the materials related to the study. All video recordings and materials related to the study will be stored in locked cabinets at your child's school or in my home. Only I, my SIUC supervising professor, and a research assistant will view the video recordings. After the completion of the research study, the video recordings and all related materials will be destroyed.

Your child's participation in this study is voluntary. If you do not want your child to participate in this study it will not result in any penalty or loss of benefit to which your child is entitled. You may cancel your child's participation in this study at any time without penalty or loss of benefits to which your child is entitled. Students who are not participants in the study will remain in the classroom, but will be excluded from the video recordings, data will not be collected on them, and their school records will not be examined.

I have read the information above. I understand by signing this form I give consent for my child to participate in this research study. The researcher has permission to collect data on my child as he or she participates in lessons, and examine my child's school records.

☐ **Yes. I agree.** ☐ **No. I do not agree.** Child's Name: _____

 Parent's Printed Name

 Parent's Signature

 Date

My signature below indicates my consent to video record my child FOR ONE 50-MINUTE CLASS PERIOD EACH DAY FOR APPROXIMATELY 12 WEEKS for this study.

 Parent's Signature

 Date

Questions about this study can be directed to me or to my supervising professor, Dr. Nancy Mundschenk, Department of Educational Psychology and Special Education, SIUC, Carbondale, IL 62901-4618. Phone (618) 453-1810.

Thank you,

Kim Johnson-Harris, M.S.Ed.
 XXX-XXX-XXXX
 kjharris@sui.edu



This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Sponsored Projects Administration, SIUC, Carbondale, IL 62901-4709. Phone (618) 453-4533. E-mail: siuhsc@siu.edu

Appendix I Student Assent Form

Title of Study: The Effect of Universal Design for Learning on the Academic Engagement of Middle School Students

Researcher: Kim Johnson-Harris, Department of Educational Psychology and Special Education, Southern Illinois University Carbondale, XXX-XXX-XXXX

2/19/13

Dear _____,

My name is Ms. Johnson-Harris. I am a college student. I am doing a research study to learn how teachers can improve their teaching by planning for lessons differently. This research may result in improved instruction for middle school students.

In order for me to see the lessons that your teacher teaches during the study, video recorders will be set up in your classroom during this 50-minute class period (math, English, science, or social studies) every day for about 12 weeks. I will look at the video recordings after the school days to see how your teacher teaches lessons and to collect data on how students respond to the lessons.

If you agree to participate in the study, you do not have to do anything extra. Your agreement to participate means that it is ok for you to be on the video recording, ok for me to collect data on how you respond to lessons, and ok for me to look at your school records. You will not be identified by name on any materials related to the study.

It is up to you if you want to be in the study. No one will be upset with you if you do not want to be in the study. If you are not in the study, we will exclude you from the video recordings, I will not collect data on how you respond to lessons, and I will not look at your school records. If you agree to be in the study, but later decide you don't want to be in it anymore, that is ok too.

I read the information on this page or listened while someone read it to me. I understand that if I sign the line below I am agreeing to be in the study and saying it is ok to collect data on how I respond to lessons, and look at my school records.

Student's Signature

Date

My signature below indicates that it is ok to video record me FOR ONE 50-MINUTE CLASS PERIOD EACH DAY FOR APPROXIMATELY 12 WEEKS for this study.

Student's Signature

Date



This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Sponsored Projects Administration, SIUC, Carbondale, IL 62901-4709. Phone (618) 453-4533. E-mail: siuhsc@siu.edu

Appendix J UDL Professional Development PowerPoint Slides

UNIVERSAL DESIGN FOR LEARNING

Kim Johnson-Harris

Universal Design

The idea of universal design originated in architecture.

Universally designed products and structures are designed with all potential users in mind (Mace, 1997).

Universal Design for Learning
takes the concept of
Universal Design
and applies it to
education and learning.

In UDL, instruction is designed
ahead of time with ALL potential
learners in mind.

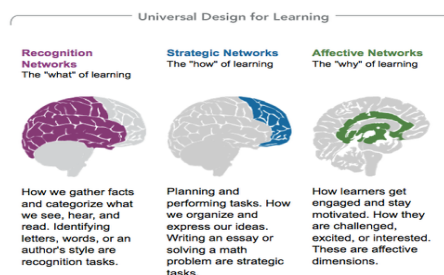
The Principles of UDL

Multiple Means of Representation

Multiple Means of Action & Expression

Multiple Means of Engagement

Brain Research



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Multiple Means of Representation

- ✓ Promote proper perception
- ✓ Promote understanding
- ✓ Promote comprehension

Multiple Means of Action & Expression

- ✓ Flexible interaction with material
- ✓ Flexible assessments
- ✓ Support executive functioning

Multiple Means of Engagement

- ✓ Spark interest
- ✓ Sustain effort
- ✓ Support self-regulation skills

UDL & Technology

- Digital natives
- Web-based resources
- Computer-based supports

Students with EBD

- ◆ Students with EBD have:
 - ✓ inappropriate behavior
 - ✓ academic learning problems
 - ✓ poor interpersonal relationships (Landrum, Tankersley, Kauffman, 2003)

- ◆ Addressing academic and behavioral issues simultaneously may improve academic outcomes (Bradley, Doolittle, & Bartolotta, 2008; Gable, Hendrickson, Tonelson, Van Acker, 2002; McIntosh, Chard, Boland & Homer, 2006).

UDL provides a framework to address all student needs simultaneously.

UDL Principles & Students with EBD

- ◆ Multiple Means of Representation
 - Audio textbook with or without a strategy improved acquisition of secondary-level content (Boyle et al., 2003).
- ◆ Multiple Means of Action & Expression
 - Problem behaviors decrease when learners have choices and activities that incorporate their interests (Clark, et al., 1995; Denton, 2005; Jolivet, Wehby, Canale, & Massey, 2001)
- ◆ Multiple Means of Engagement
 - Explicitly taught self-regulation skills or self-monitoring skills may make it possible for students with EBD to maintain appropriate behavior in the general education classroom (Menzies, Lane, & Lee, 2009; Vanderbilt, 2005; Zimmerman, 2008).

Backwards Design

- Identify the desired results.
What do I want students to learn from this lesson?

- Determine acceptable evidence.
How can students show me they have learned it?

- Plan learning experiences and instruction.
What learning experiences and activities will help my students understand the material?



Class Learning Profile

Class Learning Profile

Directions: Use this form to make note of learner strengths, interests, and preferences as they relate to the role of disciplines. Use as a tool for planning and instruction.

	Learner Strengths	Learner Weaknesses	Learner Interests & Preferences
English Language Learners			
Students with Disabilities			
Gifted/Talented			

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Goals...

- should be aligned with standards.
- should be separate from the means for achieving them.
- should focus on learning rather than performance.
- should be clearly defined/stated so they can be easily communicated to learners.

Assessments...

- should be intentionally planned after careful consideration of learner strengths, interests, and preferences (class profile).
- should be planned to inform instructional decisions (formative assessments).
- should allow for learners to demonstrate understanding in flexible ways.

Instruction & Learning Activities...

- should relate directly to the learning goals.
- should be intentionally planned after careful consideration of individual learners' strengths, interests, preferences (class profile).
- should incorporate technology when appropriate and available.

Multiple Means of Representation

- Integrate scaffolds/supports so learners properly perceive information.
- Integrate scaffolds/supports so learners easily understand information.
- Integrate scaffolds/supports so learners comprehend information.

Multiple Means of Action & Expression

- Allow for learners to interact with the material in multiple/flexible ways.
- Allow learners to express their knowledge and ideas in multiple/flexible ways.
- Support learners' executive functioning as they learn new material.

Multiple Means of Engagement

- Spark interest through emphasizing relevance, value and choice.
- Sustain effort through specific feedback.
- Explicitly address self-regulation skills.

Please complete the professional development validity checklist.

UDL Professional Development Validity Checklist

Directions: Check each item that was addressed during the professional development session.

	Addressed	Not Addressed
UDL origins		
UDL conceptual underpinnings and related brain research		
UDL principles		
UDL and technology		
UDL and students with EBD		
UDL lesson plan design		
Collaborative lesson plan design session		

Percent Agreement:

Collaborative Lesson Plan Design

UDL Lesson Plan Guidelines

1. Identify the desired results.

What do I want students to learn from this lesson?

Goals should:

- ☐ be aligned with standards.
- ☐ be separate from the means for achieving them.
- ☐ focus on learning rather than performance.
- ☐ be clearly defined/stated so they can be easily communicated to learners.

2. Determine acceptable evidence.

How can students show me they have learned it?

Assessments should:

- ☐ be intentionally planned after careful consideration of learner strengths, interests, and preferences (class profile).
- ☐ be intentionally planned so learners can demonstrate understanding in flexible ways.
- ☐ be planned to inform instructional decisions (formative assessments).

3. Plan learning experiences and instruction based on UDL principles.

What learning experiences and activities will help my students understand the material?

Instruction and learning activities should:

- ☐ relate directly to the learning goals.
- ☐ be intentionally planned after careful consideration of individual learners' strengths, interests, preferences (class profile).
- ☐ incorporate technology when appropriate and available

To implement multiple means of representation:

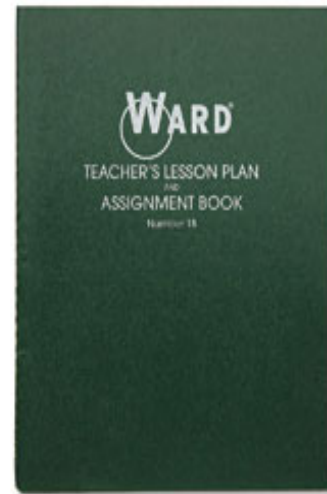
- ☐ Integrate scaffolds/supports so learners properly perceive information.
- ☐ Integrate scaffolds/supports so learners easily understand information.
- ☐ Integrate scaffolds/supports so learners comprehend information.

To implement multiple means of action and expression:

- ☐ Allow for learners to interact with the material in multiple/flexible ways.
- ☐ Allow learners to express their knowledge and ideas in multiple/flexible ways.
- ☐ Support learners' executive functioning as they learn new material.

To implement multiple means of engagement:

- ☐ Spark interest through emphasizing relevance, value and choice.
- ☐ Sustain effort through specific feedback.
- ☐ Explicitly address self-regulation skills.



Appendix L CAST Class Learning Profile

CAST_App_Template 1
p. 5

Class Learning Profile

Blank Template


Grade: **Teacher:** **Subject:** **Standard:**
Goal:

Network	Students— Strengths	Students— Weaknesses	Students— Preferences/Interests
Recognition (Learning “what”)			
Strategy (Learning “how”)			
Affect (Learning “why”)			

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Appendix M UDL Resource Packet


MULTIPLE MEANS OF REPRESENTATION**Present information in multiple ways so each learner can properly perceive it:**

*Avoid lecture and students reading aloud as the only means of presenting information.	Use PowerPoint with images, video clips, animation.		Use video clips rather than full videos.
Demonstrate the concept with tangible items (e.g., experiment).	Refer students to the digital textbook or hyperlinked documents on your website. Demonstrate how to access them during this lesson (not just the first week of school).		

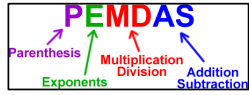
How to create a hyperlink:

1. select the word you want to define or explain further
2. click *insert* then *hyperlink*
3. click *place this in a document or document*
4. click *screen tip* and type in what you want to appear in the box
5. click *ok*
6. click *locate* or *target frame* and select *top of document*
7. click *ok* and click *ok* again
8. when you hover your mouse over the word, your additional information will appear in a box

Support understanding:

Explain the structure of the textbook section or handout (do it for each lesson, not just the first week of school).	Pre-teach vocabulary that will come up during this lesson (not as the first independent assignment).	Allow some students to use the on-line textbook. -OR- Type handouts with hyperlinks and make the documents available for students to access from your website.
Allow students to use text-to-speech software to support decoding difficulties. www.naturalreaders.com	*Show images to help student understand the meaning of the word. 	Make students aware of how to access these supports on your website.
*Free and easy website can be made through Word Press: www.wordpress.com Check mine out at www.kimjohnsonharris.com Under the "English" tab you'll see links to various supports. On the right, you'll see a link to the textbook and other activities students can do to support their learning.		

Support comprehension:

Tap into learners' previous experiences and knowledge.	Provide a list of key terms that learners can access instantaneously rather than looking up each word they do not know.	Go ahead and point out the BIG IDEAS and patterns .
Teach how to use graphic organizers and then make them available and encourage their use. They can be interactive and available on the web: www.bubbl.us Or they can be printed copies: www.teachervision.fen.com (click on graphic organizers)	Teach strategies and mnemonics for remembering a list or steps in a process. 	
Review before and after a lesson. *Numerous ideas and even pre-made games are available with a simple internet search.	Make students aware of how to access these supports on your website.	



MULTIPLE MEANS OF ACTION & EXPRESSION

Options for learning experiences:

<p>Provide several options of learning experiences that allow learners to reach the same learning objective.</p> <ul style="list-style-type: none"> • Listen to the teacher lecture • Discuss with partner or group • Watch a video OR video clip • Internet search/exploration • Read a book or magazine article <ul style="list-style-type: none"> - Audio book - Digital book • Computer programs/software • Talk to someone who knows the topic • Solve a problem • Teach someone else • Create a concept map 	<p>Allow learners to choose to work individually, with a partner or with a small group.</p> <p>Allow learners to create their own learning experience based on their strengths, interests, and preferences.</p>
---	---



Options for assessments:

<p>Provide several options for how learners can show you that they have mastered the learning objective.</p> <ul style="list-style-type: none"> • Write a blog post • Draw and label a diagram/picture • Perform a skit or write a song • Create a PowerPoint • Make a poster, brochure, diorama • Role play • Games • Interviews • Teach the teacher • Learning journal • Discussion • Puppet show • Think aloud • Retelling • Concept map • Think-Pair-Share • Make a cartoon 	<p>Use a rubric to help you determine if the learning objectives have been met.</p> <p>Search: "rubistar"</p>  
--	--



Support executive functioning:

<p>Show the step-by-step approach to a task then provide a visual checklist with the same information and examples.</p>	<p>Use a soft alarm so learners can self-check whether they are on-task.</p>	<p>Use a visual schedule and review it often.</p> <p>Use visual calendar to keep track of long projects.</p>
<p>Create separate work areas with complete sets of supplies.</p>	<p>Create, or help learner create a checklist or to-do list with estimates of time frames needed to complete components of a task.</p>	<p>Write due dates on top of assignments.</p>
<p style="text-align: center;">Plan for organization time.</p>		



MULTIPLE MEANS OF ENGAGEMENT

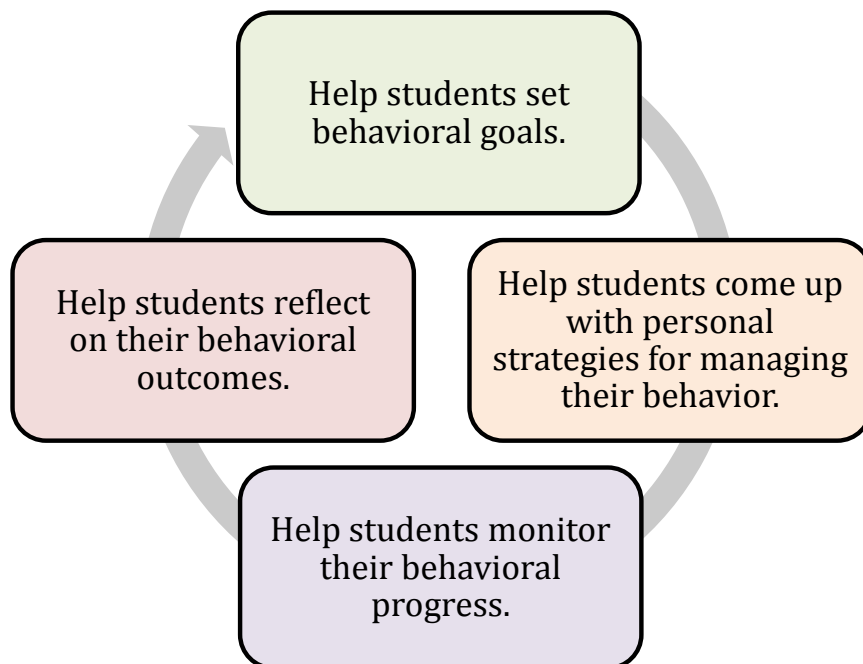
Support interest:

Emphasize why learning this is important.	Link new topic to existing interests.	Be enthusiastic about the topic.
Provide CHOICES for how the objective is achieved.		
Use technology when possible. Our students are “ digital natives ”. They are engaged by technology.	Connect what you are teaching to the real world.	

Support effort:

Did you know that learners with low motivation believe that intelligence is fixed and cannot change? They interpret exertion of effort to mean that they have limited ability.		
Help learners set learning goals.	Give frequent and specific feedback .	Attend to successes more than failures.
Point out where learner went from not knowing to knowing . → → → → → → → → → →	Point out where learner effort resulted in success.	Adjust the degree of difficulty or level of support to promote success.

Support self-regulation:



Appendix N Researcher-Designed Lesson Plan for Teacher B

Two-step Equations Lesson Plan**Goal:**

Students will understand how to solve two-step equations.

Assessment:

Students will demonstrate understanding of this concept through one of the following methods:

1. Think-aloud and demonstrate problem solving at board for teacher and a few peers.
2. Create a handout that could be used by other students that shows the concept steps in number and written format.
3. Other ideas as approved by teacher.

*This assessment does not need to be graded. It can be a formative assessment used to inform instructional decisions.

Learning Activities:

*Let students know that they can access information on the Internet outside of school. Give them the **handout** with website information and show the websites to students so they will know how to access them and navigate them on their own.

<http://www.thegreatmartinicompany.com/algebra/algebra-home.html>

<http://www.ixl.com>

<http://www.aaamath.com/equ725x6.htm>

*In addition to your normal lesson and students taking notes, you could show one of these videos in order to have multiple means of representation.

Show the following video on two-step equations:

<http://www.youtube.com/watch?v=pKaZ3igfXVc>

Search: Math Dude Solving Two-Step Equations (5:37 min)

Or this one...

<http://www.youtube.com/watch?v=zTUa11Fb-Dw>

Search: Solving two-step equations using multiplication and division by Schmoop (2:37 min)

1. Have students work individually, with a partner, or in small groups. They will choose from the following activities:
 - A. Practice problems (that you provide) done with paper and pencil, white boards, etc.
 - B. Practice problems (that you provide) done with manipulatives (post-its and pennies). Use one post-it for each side of the equation. Use paperclips to represent X's and pennies to represent constant numbers. Students should write down the problem and the steps too. The manipulatives are to provide support for understanding along with the written format as you teach it.
 - C. Use a lap-top computer to play the "HoopShoot" game which provides practice problems: <http://www.math-play.com/Two-Step-Equations-Game.html>

*these activities can also be used if with the solving inequalities lesson if you get to that.

Appendix O Researcher-Designed Lesson Plan for Teacher C

3-Day Atmosphere/Weather Lesson Plan**Goal:**

Students will understand the basic concepts of atmosphere and weather.

Assessment:

Students will demonstrate understanding of basic atmosphere and weather concepts by producing one of the following products:

1. A children's book explaining weather in first-grader terms/language.
2. A poster.
3. A song or rap (including album cover).
4. A poem (including illustration).
5. Other product if approved by teacher.

The products will be graded via the following rubric:

CATEGORY	3	2	1	0
Knowledge Gained	Student or students can accurately answer ALL questions related to facts in the product and to technical processes used to create the product.	Student or students can accurately answer MOST questions related to facts in the product and to technical processes used to create the product.	Student or students can accurately answer SOME/FEW questions related to facts in the product and to technical processes used to create the product.	Student or students can accurately answer NONE of the questions related to facts in the product and to technical processes used to create the product.
Writing/Grammar	There are no grammatical mistakes in the product.	There are no grammatical mistakes in the product after feedback from an adult.	There are 1-2 grammatical mistakes in the product even after feedback from an adult.	There are several grammatical mistakes in the product even after feedback from an adult.
Graphics/Pictures	Graphics go well with the text and there is a good mix of text and graphics.	Graphics go well with the text, but there are so many that they distract from the text.	Graphics go well with the text, but there are too few and the product seems \"text-heavy\".	Graphics do not go with the accompanying text or appear to be randomly chosen.
Attractiveness/Neatness	The product has exceptionally attractive formatting and well-organized information.	The product has attractive formatting and well-organized information.	The product has well-organized information.	The product's formatting and organization of material are confusing to the reader.

Learning Activities:

*Let students know that they can access information on the Internet outside of school. Give them the **handout** with website information and show both of these websites so students will know how to access them and navigate them on their own.

www.theweatherchannelkids.com

<http://urbanext.illinois.edu/treehouse/index.cfm>

Day1:

1. Atmosphere

A. Have students read the articles “Layers of Earth’s Atmosphere” and “Science for Kids: The Earth’s Atmosphere” independently or in pairs and discuss with a classmate or a partner.

*Students can do the activity attached to “Layers of Earth’s Atmosphere” for fun if they want, but don’t make that the activity for the day.

B. Encourage students to read interactively by underlining, highlighting or making notes in the margins.

C. Have each pair or individual report one piece of information that was important.

D. Show video clip on the atmosphere and layers of the atmosphere:

<http://www.youtube.com/watch?v=3CerjbZ-dm0>

“A Journey Through the Atmosphere”

2. Discuss project so students can start thinking about what they would like to do. Remind them that this project will be due at the end of class on day 3 and that they will get more information on tomorrow. They can start brainstorming ideas and sketching out a rough draft today if there is time. You can give them the rubric today, too.

Friday:

1. Weather

A. Have students read the attached article “Weather Facts” independently or in pairs and discuss with a classmate or their partner.

B. Encourage students to read interactively by underlining, highlighting, or making notes in the margins.

C. Have each pair or individual report one piece of information that was important.

D. Show video clip on weather:

<http://www.youtube.com/watch?v=qABhFeVtgWo>

“How Weather Works”

E. Show video clip on weather fronts:

<http://www.youtube.com/watch?NR=1&feature=endscreen&v=G7Ewqm0YHUI>

“What are Weather Fronts?”

2. Discuss project again.

A. Discuss project choices (choice of product and to work with partner or individually).

B. Discuss rubric. Give students a copy of the rubric. Tell them that the rubric should be attached to their product when they turn it in on day 3.

C. Give students time to work on projects.

***Provide additional resources (e.g., library books) so students can get more information as needed and from different sources.**

Monday:

1. Give students time to work on projects. **Collect them at the end of the hour.**

Appendix P Copyright Permission for Class Learning Profile

Re: Copyright permission



David Gordon <dgordon@cast.org>

Mon 2/24/2014 4:36 PM

To: ☐ Kimberly Michell Johnson-Harris;

[Bing Maps](#)

Dear Kim Johnson-Harris:

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Sincerely,

David Gordon

David Gordon

Director of Publishing & Strategic Communications

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Wakefield, MA 01880

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Twitter: http://www.twitter.com/CAST_UDL

Facebook: <http://www.facebook.com/CenterforAppliedSpecialTechnology>

YouTube: <http://www.youtube.com/UDLCAST>

Appendix Q Copyright Permission for Behavioral Observation of Students in Schools

RE: Republication Permissions Request

✖ DELETE ← REPLY ⇐ REPLY ALL → FORWARD ⋮



Mandy.Sparber@guilford.com on behalf of Permissions@guilford.com

mark as unread

Wed 2/19/2014 8:10 AM

To: ☐ Kimberly Michell Johnson-Harris;

📎 1 attachment



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Please let me know if you have any questions.

Best,

Mandy

VITA

Graduate School
Southern Illinois University Carbondale

Kimberly M. Johnson-Harris

kimjohnsonharris@gmail.com

Southern Illinois University Edwardsville
Bachelor of Science, Special Education, December 1996

Southern Illinois University Edwardsville
Master of Science in Education, Special Education, May 1999

Dissertation Title:

The Effects of Universal Design for Learning (UDL) on the Academic Engagement of Middle School Students

Major Professor: Nancy A. Mundschenk

Publications:

Johnson-Harris, K. M., & Mundschenk, N. A. (in press). Working effectively with students with BD in a general education classroom: The case for universal design for learning. *The Clearing House: A Journal of Educational Strategies, Issues, and Ideas*.